# The American

# GAS LIGHT JOURNAL.

(ILLUSTRATED.)

DEVOTED TO THE INTERESTS OF

## ILLUMINATION, HEATING, VENTILATION

AND

## GENERAL SCIENCE.

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# THE AMERICAN GAS LIGHT JOURNAL

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[OFFICIAL NOTICE.]

### Twenty-sixth Annual Meeting of the New England Association of Gas Engineers.

OFFICE OF THE SECRETARY, December 26, 1895.

The twenty-sixth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 19 and 20, 1896.

The meeting will be called to order at 10 A.M., Wednesday, February 19. A good list of papers on timely subjects has already been promised. The subjects and authors will be announced later.

The topics for discussion which proved of so much interest last year will be continued this year, and several gentlemen have arranged to speak on the subjects already selected.

The Question Box will be a feature as usual. Members will please forward their questions as early as possible.

The members will dine together on Wednesday evening.

Application blanks may be had of the Secretary. Applications for membership, and all other matters for the consideration of the Directors, should be sent to the Secretary before Tuesday evening, February 18.

C. F. PRICHARD, Secretary.

[OFFICIAL NOTICE.]

### January Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, January 2, 1896.

The January meeting of the Society of Gas Lighting will be held in the Arena, No. 39 West 31st street, New York, at 3 P.M. of Thursday, the 9th inst.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

### January Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, January 2, 1896.

The January meeting of the Guild of Gas Managers will be held at Young's Hotel, Boston, Mass., at noon, of Saturday, the 11th inst.

A. K. QUINN, Secretary.

## MAIN PIPE EXTENSIONS.

With the advent of a new year, the question of obtaining additional consumers and increasing the output of gas will be one that will command the attention of the gas men generally. It is presumed that the business centers of cities and towns have received due attention in the matter of being extensively, if not wholly, supplied with gas, and hence any appreciable addition to gas companies' business will have to come from other territory. We have noted the tendency of late of residents to get away from the noisy business streets and to settle in the more quiet suburbs or outlying districts. The great advances made in rapid transit facilities, the ability of being able to communicate freely and quickly with one's residence from his place of business, and vice versa, through the medium of the telephone, the very satisfactory terms offered by the various building and loan associations to assist parties of moderate means in building their own residences, are all potent factors in inducing a more extensive distribution of population than has hitherto been the case. The present conditions have come about in a re-

markably short space of time, and the evolution has been so rapid that in but few instances have gas companies been in position to supply these new premises with gas. In these days of advancement in all other lines of industry it is unfortunate that many companies still persist in adhering to their time-worn policy of what they are pleased to style "conservative management." While we do not advise promiscuous extensions of the main system, we feel that any executive who cannot determine where regular and promising returns are likely to be had, and where it is desirable that the product of their plants shall be accessible, and who then does not branch out and secure this business, is very short-sighted indeed. The time when the expense of main extensions and the introduction of house services should be borne by the consumer is past, and if additional custom is sought on these lines, it is not at all likely that the results will be very encouraging.

We are pleased to note that some companies have shown sufficient forethought to anticipate the needs of the residents of new territory, and have not only not waited until their services were asked for, but have assisted in making a substantial addition to the inducements offered in the way of modern conveniences, and thus created a field for their business that would perhaps not otherwise have been opened. This liberal policy has been satisfactorily appreciated, and the companies have received very flattering returns in consequence. With these examples before us, we think it our duty to express ourselves unreservedly in favor of other companies doing likewise, and we insist that the net income to be derived will be a very gratifying percentage on the outlay required. The prices of metals are low, and cast iron pipe, lead and yarn can be had at very tempting figures.

We trust that when the returns for 1896 are in they will show that a majority, if not all of the gas companies, have acted upon our advice and profited by the experience of those who had sufficient acumen to grasp the opportunities offered and make the most of them.

## INSPECTOR CLINCHY'S SUCCESSOR.

Governor Morton has appointed Mr. James L. Stewart, a resident of this city, to the position of State Inspector of Gas Meters, which place was made vacant by the more or less forced resignation of the former incumbent, Mr. Anthony Clinchy. While the investigation, by a committee of the State Senate, of Clinchy's conduct of his "department" may have revealed a trifle of slipshod methods of management therein, the real trouble with Clinchy, in the eyes of the dominant political rulers of the State, was his politics; hence the change. As Mr. Stewart (so the newspaper advices of last week said) is "one of the most aggressive Platt Republicans in the city," he is not offensive to the party in power; and those who favored or urged his appointment point his fitness for the place with the remark that "he is a machinist." Meanwhile, the gas companies and the gas meter manufacturers that are paying the piper we presume ought to be thankful that a blacksmith was not named for the berth instead of a "machinist."

## THE TWELFTH MEETING OF THE OHIO GAS LIGHT ASSOCIATION.

Mr. A. P. Lathrop, Secretary and Treasurer of the Ohio Gas Light Association, notifies us that the Executive Committee have been up and doing respecting the advance arrangements for the Association's twelfth annual meeting, which is to be held at Cincinnati, Ohio, on the 18th and 19th days of March. The Grand Hotel has been determined upon as headquarters, and the business sessions will also be carried on there, a dual arrangement that is sure to be appreciated by those who shall attend the convention. The hotel, both as to nearness to the main railway stations of the city, and as to its capacity to receive, house and care for, in acceptable manner, a goodly number of guests, can be said to meet every reasonable requirement. The paper list is a promising one, and the outlook for a successful meeting, even at this advance date, is undeniable.

MR. THOMAS LITTLEHALES, the genial Britisher who has, for the past 21 years, been the efficient Engineer and Manager of the Hamilton (Ontario) Gas Light Company, has voluntarily resigned his position with the Canadian Company in order to take up his residence in the States. On the afternoon of December 19th, 1895, the employees of the Gas Company presented Mr. Littlehales, their retiring Manager, with a handsome, heavy gold chain and charm as a token of their esteem, which provides him with a suitable attachment for a fine gold watch presented by the same admirers on a previous occasion. Mr. Littlehales is now well watched and guarded.

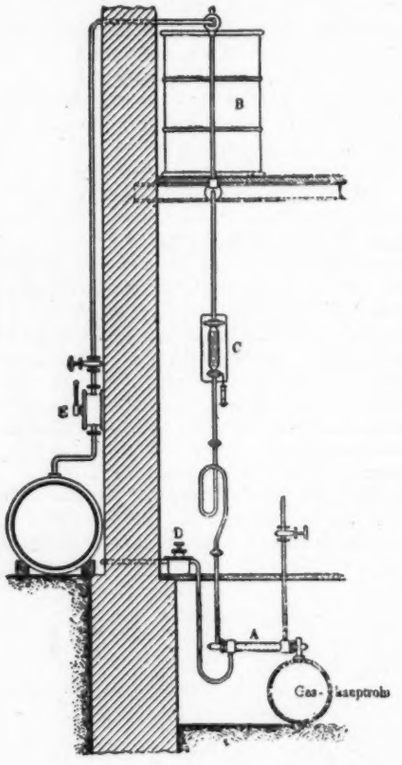
## Method of Preventing the Freezing of Gas Pipes.[1]

Mr. Bueb, chemist to the German and Continental Gas Company, of Dessau, has invented a method for preventing, in a permanent way, the freezing of lamps and service pipes. The method is the result of a number of experiments made by the inventor at the Dessau gas works. It consists in adding to the gas distributed to the city alcohol vapor, which sufficiently lowers the point of congelation of the liquids separated from the gas by the cold to prevent freezing and obstruction of the pipes. The necessary apparatus consists of—

The alcohol evaporator proper, *A*; a reservoir of alcohol, *B*; the regulator of admission, *C*; a receiver of condensed vapor, *D*; a pump, *E*.

The pump is connected by an iron tube with the bunghole of the alcohol barrel, and by this means the liquid is raised to the reservoir *B*, provided with a side tube of glass to regulate the level. Since, during filling, it is advisable not to have any pressure in the tank, it is connected by a pipe to the gas main, so as to save any alcohol that may vaporize.

A pipe connects the reservoir *B* to the regulator *C*, so that the exact amount of alcohol wanted can be instantly regulated. To measure the alcohol, a cylinder having a scale is used showing the quantity flowing




in a given time, a stopcock being placed below the regulator and the tube below it being bent back on itself.

From the admission regulator the alcohol passes through a tube furnished with regulating valve to the evaporator *A*, in which the evaporation is produced by steam or directly by gas flame; the vapor then passes to the service pipe and becomes mixed with the gas.

When steam is used a condenser *D* is placed behind the evaporator; with direct heat this is not needed.

The apparatus is in use in 29 gas works, principally in Dessau, Magdeburg, Chemnitz, Potsdam, Cronstadt (Russia), etc.

In most places the usage is to place the apparatus in connection with the pressure regulator, or the evaporator may be connected with the gas pipe by a short connection. The alcohol reservoir may be placed on the first floor or on brackets in the basement, while the pump may be placed in the open air. As the connection between the evaporator and the service pipe is composed of a single iron pipe of small diameter, it can be easily placed.

The addition of alcohol to the gas may begin a half hour before the

1. Abstracted and translated for the JOURNAL by Herman Poole.

evening output, and may be so regulated as to add, for a temperature of 14° F., about 1 ounce to 1,000 cubic feet; for a lower temperature, from one third to one-half more of 95 per cent. alcohol. Three sizes of apparatus are made, as follows:

| | Diameter. | Height of Reservoir *B*. | Capacity. | Length of Evaporator *A*. |
|---|---|---|---|---|
| Size 1 | 28.0 in. | 40.0 in. | 1,412.7 cu. ft. | 17.5 in. |
| " 2 | 33.5 " | 49.0 " | 2,301.5 " | 39.3 " |
| " 3 | 36.0 " | 50.3 " | 2,825.4 " | Double, 47.0 " |

| Capacity of Measuring Cylinder | Exterior Diameter of Measuring Cylinder. |
|---|---|
| 6.1 cubic inches | 1¼ inches. |
| 12.2 " | 1.7 " |
| 18.3 " | 2 1/16 " |

| | | |
|---|---|---|
| Size 1—Sufficient for works producing | | 70 million. |
| " 2— | " " " | 70 to 140 " |
| " 3— | " " " | over 140 " |

## The Determination of Methane and Hydrogen by Explosion.

By Augustus H. Gill and Samuel P. Hunt.*

In making an analysis of illuminating gas by Hempel's method it was noticed that the determination of the constituents by explosion was by no means as accurate as that made by absorption. This had been observed by Hinman and is probably due (1) to the fact that an aliquot part of the residue (after all absorptions had been made) containing the methane and hydrogen is used, necessitating the multiplication of errors by a factor as large as four or five, and (2) to the possible absorption of the carbon dioxide formed by the water in the burette. To obviate these difficulties it was determined to use all the gas left after the absorptions had been made, with mercury as the confining liquid and to explode with pure oxygen rather than with air. Instead of using the gas left after the actual absorptions, which would be of unknown composition and troublesome to obtain, an artificial mixture, made from methane, hydrogen and nitrogen, approximating closely to the composition of the residue, was employed.

*Preparation of the Gaseous Mixtures.*—The hydrogen was prepared by the electrolysis of water; it was then shaken up with potassium pyrogallate to remove the slight quantity of oxygen with which it was mixed, and upon analysis was found to contain four and two tenths per cent. of nitrogen. In making an analysis of hydrogen, we would lay especial emphasis upon the necessity of having the ratio of explosive mixture to inert gases as great as 1:6, as Hempel recommends, in order not to burn the nitrogen.

This is considerably larger than that which Bunsen recommended, which may vary between the limits 26 and 64 of combustible gas to 100 of incombustible. Unless the larger ratio be adopted the determination of hydrogen may come 2½ per cent. high, as is shown by the following table:

Table I.—*Determination of the Purity of the Hydrogen.*

| Hydrogen Taken, cc. | Air Used, cc. | Ratio. | Per Cent. Hydrogen. |
|---|---|---|---|
| 20.5 | 185.0 | 1:5.7 | 95.8 |
| 20.5 | 185.0 | 1:5.7 | 95.8 |
| 50.0 | 115.0 | 1:1.2 | 98.3 |
| 50.0 | 115.0 | 1:1.2 | 98.0 |

The nitrogen probably burns to $N_2O_4$, as the characteristic dark red fumes of this gas were frequently seen in the pipette. By the Griess test with $\alpha$ naphthylamine we were able to prove the presence of quite a quantity of nitrites in several cases.

In making the analyses of hydrogen by the first method it was necessary to connect and disconnect the burette three times in each case; the error which might be introduced was determined with the following results:

Table II.—*Showing the Errors in Manipulation in Connecting the Burette and Pipette.*

| Burettefuls. | Air Put In, cc. | Air Taken Out, cc. | Errors, cc. | Remarks. |
|---|---|---|---|---|
| 3 | 210.3 | 207.4 | −2.9 | No connections wired. |
| 3 | 216.0 | 216.6 | +0.6 | |
| 3 | 210.2 | 208.7 | −1.5 | |
| 3 | 213.3 | 213.8 | +0.5 | All connections wired but one. |
| 1 | 97.6 | 97.2 | −0.4 | All connections wired. |
| 1 | 97.2 | 96.8 | −0.4 | |
| 3 | 237.5 | 237.3 | −0.2 | |

The oxygen was obtained in a similar manner to the hydrogen and contained 1.6 per cent. hydrogen and 1.4 per cent. nitrogen. The nitrogen in both these gases probably came from the distilled water electrolyzed, which was not freshly boiled before use.

The nitrogen employed was prepared by removing the oxygen from the air by means of phosphorus, allowing the gas to stand in the light 24 hours to decompose any ozone, and subsequent treatment with a small quantity of alkaline pyrogallate.

An attempt was made to prepare the methane by the usual method of heating sodium acetate with sodium hydroxide and quicklime; the gas was found to be so largely contaminated with hydrogen—as high as 10 per cent. being found—as to be unfit for our purpose. This result is directly at variance with the statement of Freyer and Meyer, who say that this process "furnishes a very approximately pure gas."

Nor did the method of Gladstone and Tribe, the reaction of a zinc-copper couple upon methyl iodide, at first yield any better results, owing possibly to the water in the alcohol used. To obviate this and also prevent the possible formation of ethane, anhydrous methyl alcohol was substituted for the ordinary alcohol usually employed. The air in the apparatus was displaced by carbon dioxide and the methane collected, treated with potassium hydroxide to absorb this impurity. An analysis of the gas thus made, by explosion with oxygen and also with air—care being taken to avoid burning any nitrogen—showed the methane to be chemically pure.

The gases thus prepared and also the mixtures made from them, were stored in bottles provided with doubly-perforated rubber stoppers carrying a tube for the introduction of water and a tube for the egress of the gas. To render these absolutely tight, the stoppers were fastened in by fitting a brass plate to cover the top of the stopper, and by means of brass bolts and nuts passing through wire loops around the neck of the bottle, pressing the stopper firmly into the neck of the bottle. Joints of this kind are sufficiently tight to withstand a pressure of hydrogen. To reduce the possibility of the transfusion of the gases to a minimum, a slight outward pressure was maintained in each bottle and it was inverted in a pan of water. The separate gases were kept in this way for about two months, freshly distilled water being used to displace the quantities requisite for the various mixtures. These mixtures made from them stood in no case over two days, before being completely used up, so that the amounts of methane and hydrogen dissolved by the distilled water, used to displace the various volumes taken, were negligible; the coefficients of absorption of the various gases not being widely different the ratio of the gases would remain the same within the errors of the analysis.

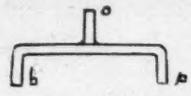
The gases were mixed by displacing the water from a liter bottle with the proper amounts of methane, hydrogen and nitrogen—measured by a burette—care being taken to leave some of the water to act as a stirrer, and then thoroughly shaking the bottle. By connecting this with a bottle of distilled water by means of a siphon, the requisite quantity of gas for an experiment could be displaced into the burette.

*Method of Procedure.*—Fifty cubic centimeters—this being about the usual residue from Boston gas after all the absorbable constituents had been removed—were measured out, mixed with about 60 cc. of oxygen and burned in an explosion pipette devised by one of us. This combustion took place in different ways, at first as one explosion, and later by two explosions, with the idea of diminishing the error due to the possible combustion of nitrogen. In using the latter method it was found necessary to make the ratio of the explosive mixture to inert gases, nearly 1:2 in order that any explosion might take place; with some mixtures not strong enough to explode, if care be not taken to pass the spark but a short time, the fine platinum wire becomes heated and finally glows, similar to the platinum sponge in the Döbereiner lamp, producing a very slow combustion, causing annoyance and delay in the analysis. A rough experiment may very well be made at first, to determine the composition of the gas under investigation and then suitable quantities of oxygen added for the first and second explosion.

The residue in the explosion pipette was, in every case, transferred to an ordinary Hempel burette for measurement, mercury, instead of water, being the confining liquid; the gas was passed into potassium hydroxide and then into pyrogallate for the determination of carbon dioxide and oxygen. It is almost impossible to avoid sucking back some of the absorbents into the burette, which being strongly alkaline, would vitiate the next analysis by absorbing carbon dioxide; to obviate this difficulty the instrument was washed out with dilute acetic acid[1] and then with water, almost filled with mercury allowed to stand about half an hour, the water which collected at the top displaced and then used for the next determination.

*In *Journal of American Chemical Society*, Dec., '95.

1 If hydrochloric acid be used it forms a precipitate of mercurous chloride upon the walls of the pipette, coming from the mercurous salts produced by the action of the oxides of nitrogen upon the mercury.



Instead of using the ordinary doubly bent connecting tube, this was varied by the introduction of a T-joint, which is found especially convenient in adding successive portions of oxygen. The burette being connected at *b*, the pipette at *p*, and the oxygen at *o*, one can add the oxygen without disconnecting the burette each time. By connecting in a short tube at *o*, and filling it with mercury, the capillaries can be filled with mercury, an important point in preventing the rubber connectors from being burst by the force of the explosion. All connections should be carefully wired. By the use of two sets of apparatus two analyses may be executed at one time, in one an absorption is taking place, in another an explosion, etc. Six analyses in three hours were frequently made.

*Calculation of Results.*—The calculation of the results of the explosion was made according to the directions of Hempel, that is in accordance with the reactions.

$$CH_4+2O_2=CO_2+2H_2O.$$
$$2H_2+O_2=2H_2O.$$

The volume of carbon dioxide obtained represents the methane present, and twice this volume subtracted from the total contraction, gives the contraction due to hydrogen; this latter being multiplied by two-thirds, gives the amount of hydrogen present. Table III shows the results obtained.

TABLE III.—*Analysis of a Mixture of Methane, Hydrogen and Nitrogen by One Explosion with Oxygen.*

| Mixture, cc. | Oxygen, Per Cent. | Methane, Per Cent. | Hydrogen, Per Cent. | Nitrogen, Per Cent. |
|---|---|---|---|---|
| 49.8 | 65.2 | 34.7 | 54.8 | 10.5 |
| 51.9 | 65.0 | 35.3 | 54.1 | 10.6 |
| 49.7 | 65.6 | 35.1 | 53.9 | 11.0 |
| 50.1 | 61.3 | 34.5 | 55.0 | 10.5 |
| 51.5 | 61.8 | 35.0 | 53.6 | 11.4 |
| 59.4 | 72.8 | 34.4 | 55.0 | 10.6 |
| 49.4 | 56.2 | 34.3 | 55.0 | 10.7 |
| 49.2 | 56.0 | 34.0 | 54.9 | 11.1 |
| 49.2 | 58.3 | 33.4 | 55.0 | 11.6 |
| 49.9 | 55.6 | 34.8 | 54.9 | 10.3 |
| | Average, | 34.5 | 54.7 | 10.8 |
| | Theory, | 34.7 | 53.5 | 11.8 |

The results obtained in the estimation of the methane are quite satisfactory and are probably within the limits of error of the apparatus. The hydrogen is high, due to the fact that the methane is low, and possibly also to the burning of the nitrogen.

In order to diminish the error from the latter source, a new mixture was made, and analyzed by exploding twice successively with oxygen, care being taken to add as little oxygen for the first explosion as would make the mixture combustible. Table IV. shows the results obtained.

TABLE IV.—*Analysis of a Mixture of Methane, Hydrogen and Nitrogen by Two Explosions with Oxygen.*

| Mixture, cc. | Oxygen Used, First Time. | Oxygen Used, Second Time. | Methane, Per Cent. | Hydrogen, Per Cent. | Nitrogen, Per Cent. |
|---|---|---|---|---|---|
| 51.2 | 40.0 | 40.9 | 32.6 | 46.6 | 20.8 |
| 51.1 | 41.0 | 39.9 | 32.0 | 46.5 | 21.5 |
| 56.7 | 40.0 | 50.3 | 32.1 | 46.7 | 21.2 |
| 48.5 | 31.0 | 45.7 | 32.2 | 47.5 | 20.3 |
| 50.3 | 31.0 | 49.8 | 32.4 | 48.0 | 19.6 |
| 50.9 | 32.0 | 51.1 | 32.3 | 47.6 | 20.1 |
| 53.4 | 35.0 | 45.6 | 31.7 | 48.1 | 20.2 |
| 50.9 | 30.0 | 52.9 | 32.1 | 48.1 | 19.8 |
| 49.3 | 29.0 | 47.7 | 32.2 | 47.9 | 19.9 |
| 50.7 | 31.0 | 49.6 | 32.3 | 48.5 | 19.2 |
| | | Average, | 32.2 | 47.55 | 20.25 |
| | | Theory, | 32.2 | 47.7 | 20.1 |

The results are very satisfactory, and if we compare them with those of the preceding table (III.), we see that the average is more nearly correct than that of the former, and the deviations from the mean much less. The first three present the greatest variation in regard to hydrogen, it being 1 per cent. too low, these two had the greatest proportional amount of oxygen in the first explosion, which is anomalous.

In order to obtain an idea of what takes place during the first explosion, several were performed and the per cents of methane and hydrogen which burned determined.

TABLE V.—*Showing the Amount of Methane and Hydrogen Burned when an Insufficient Quantity of Oxygen is Present.*

| Mixture, cc. | Oxygen, cc. | Methane Present, cc. | Methane Burned, cc. | Methane Burned, Per Cent. | Hydrogen Present, cc. | Hydrogen Burned, cc. | Hydrogen Burned, Per Cent. |
|---|---|---|---|---|---|---|---|
| 53.0 | 29.2 | 17.1 | 4.0 | 23.4 | 25.0 | 12.5 | 50.0 |
| 53.4 | 29.1 | 17.2 | 4.3 | 25.0 | 25.2 | 11.7 | 46.3 |
| 55.0 | 33.6 | 17.7 | 4.9 | 27.7 | 26.0 | 16.7 | 64.3 |
| 57.4 | 35.2 | 18.5 | 5.2 | 28.1 | 27.1 | 17.0 | 63.8 |

About 60 per cent. of the hydrogen burned and, contrary to the usual opinion, 25 per cent. of the methane and only about 50 per cent. of the oxygen.

By way of comparison with the usual method, a series of analyses of the same mixture was carried through, employing a smaller quantity and exploding with air; the mercury explosion pipette was used as before and the residue after explosion measured in a burette using water, as is customary, instead of mercury as the confining liquid.

TABLE VI.—*Analysis of a Mixture of Methane, Hydrogen and Nitrogen by Exploding with Air.*

| Mixture. cc. | Air. cc. | Methane. Per Cent. | Hydrogen. Per Cent. | Nitrogen. Per Cent. |
|---|---|---|---|---|
| 17.8 | 79.8 | 29.8 | 45.3 | 24.9 |
| 15.3 | 82.2 | 31.4 | 49.3 | 19.3 |
| 16.3 | 81.4 | 33.7 | 42.5 | 23.9 |
| 15.9 | 82.4 | 31.4 | 38.6 | 30.0 |
| 16.1 | 78.2 | 39.1 | 30.4 | 30.5 |
| 16.8 | 80.5 | 33.3 | 42.3 | 24.4 |
| 16.1 | 82.0 | 30.4 | 44.1 | 25.5 |
| 16.2 | 81.2 | 36.4 | 33.4 | 30.2 |
| 15.8* | 79.5 | 31.6 | 40.0 | 28.4 |
| 15.1 | 82.5 | 33.8 | 38.0 | 28.2 |
| 16.2 | 82.6 | 31.2 | 42.9 | 25.9 |
| 14.8 | 83.8 | 34.4 | 38.4 | 27.2 |
| 15.9 | 84.3 | 33.9 | 37.7 | 28.6 |
| | Average, | 33.1 | 42.2 | 26.7 |
| | Theory, | 32.2 | 47.7 | 20.1 |
| | Deviation, | +0.9 | —7.5 | +6.6 |

* These last five were measured after explosion with the mercury burette.

These figures substantiate those of Hinman, the results for methane and nitrogen being high and those for hydrogen low, the variations between the different analyses are even more marked. It is to be noticed that, contrary to expectation, the results upon the methane are high, indicating, perhaps, that the water in the burette is without appreciable solvent action upon the carbon dioxide formed. The discrepancy in the estimation of hydrogen is explained by the increase in the percentage of methane, any increment here being first doubled and subtracted from the "total contraction," and then approximately doubled in making the calculation, lowering as a consequence the hydrogen by about 4 per cent., leaving 3.5 per cent. to be accounted for.

Almost the only supposition to account for this phenomenon is the somewhat anomalous one, that under these conditions the hydrogen is not completely burned.

In order to determine the effect of certain errors, such as the reading of the burette—graduated in fifths of a cubic centimeter—and any mistakes made in transferring the gases, the following assumptions were made (Table VII.), and the deviations these might produce were calculated by the method of least squares, with the results showed in Table VIII.

TABLE VII.—*Showing the Volume of Gases Taken and the Errors Assumed in their Measurement and Manipulation.*

| | Oxygen Method. cc. | Oxygen Method. Error. | Air Method. cc. | Air Method. Error. |
|---|---|---|---|---|
| Gaseous mixture taken..... | 50. | 0.15 | 15. | 0.15 |
| Oxygen (or air) used..... | 60. | 0.15 | 85. | 0.15 |
| Residue after explosion.. ... | 33. | 0.25 | 21. | 0.25 |
| Carbon dioxide formed..... | 16. | 0.25 | 5. | 0.25 |

TABLE VIII.—*Showing the Deviations to be Expected in the Determinations of the Various Gases Upon the Assumptions in Table VII.*

| | Oxygen Method. Per Cent. | Air Method. Per Cent. |
|---|---|---|
| Methane..... | 0.51 | 1.64 |
| Hydrogen..... | 0.82 | 2.40 |
| Nitrogen (by difference).. ..... | 1.70 | 4.30 |

The results of this investigation may be summarized as follows:

(1) The method of preparation of methane by heating sodium acetate, hydroxide and lime together does not yield a pure gas.

(2) The method of determination of methane and hydrogen by one explosion yields results accurate to less than .5 per cent. of the methane and .3 per cent. of the hydrogen.

(3) The method by two explosions yields results within .2 per cent. of methane and .3 per cent. of the hydrogen.

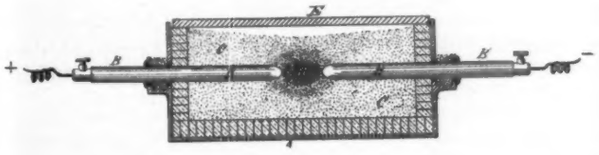
(4) When a mixture of hydrogen and methane is exploded with a quantity of oxygen insufficient for both, but more than sufficient for either, about 60 per cent. of the hydrogen and 25 per cent. of the methane and 50 per cent. of the oxygen are consumed.

(5) The method of determination of the gases by one explosion with air gives results not within .9 per cent. of the methane and 7.5 per cent. of the hydrogen.

## Art of Producing Carbide of Calcium.

United States Letters Patent (No. 551,461), dated December 17th, 1895, have been granted to William C. Clarke, of New York City, for certain new and useful improvements in the art of producing carbide of calcium. Using the words of the specification:

Heretofore this substance has been made by subjecting a mixture of pulverized carbon and lime to a high degree of heat in an electric furnace, the material to be treated being placed between vertical electrodes and an arc being maintained immediately above the material under treatment. The reduction of metallic compounds has also been effected in an electric furnace in which the electrodes are placed horizontally. In either case the furnace has been charged with such a quantity of the material to be treated that substantially all of it was subjected to the effective action of the current, or, in other words, came within the zone of fusion set up or created by the current. The result of this in the manufacture of carbide of calcium is that the carbide which, when first formed and still subjected to heat, is in a soft fused state, but hardens on cooling into a stone-like mass, sticks to the sides of the furnace, or in case a brick-lined furnace is used becomes smelted to the brick, so that it can only be removed from the furnace with much difficulty. In case, also, vertical electrodes are employed and the heat for effecting the reduction is radiated from an arc, the upper electrode becomes intensely heated by the hot gases which rise up around it, so that it is



readily attacked by the oxygen of the air and quickly destroyed, thus adding greatly to the expense of the process. In order to obviate these difficulties and reduce the cost of production, I employ an electric furnace in which the electrodes are placed horizontally, so that the hot gases set free in the process will pass directly away from the electrodes. I also charge the furnace with such a quantity of the material to be treated, consisting of pulverized carbon and lime, that a considerable proportion of the charge, both above and below the electrodes, will be outside of the zone of fusion and not sufficiently acted upon by the current to be reduced or decomposed. On bringing the electrodes together or nearly together and causing current to pass and then gradually separating the electrodes, so much of the material as receives sufficient current will be decomposed and converted into carbide of calcium. On shutting off the current before the terminals of the electrodes are drawn back to the wall of the furnace and then drawing the electrodes away from the fused mass, a core or body of carbide of calcium will remain lying in the path of the electrodes and out of contact with any part of the furnace. This can easily be dug out from the mass of pulverized material by which it is surrounded, and removed from the furnace. Some of the undecomposed carbon and lime, adjacent to the soft mass of carbide, will stick or be smelted thereto, thus forming a shell or covering which serves to protect the carbide from the action of the atmosphere, the moisture of which, as is well known, quickly combines with and decomposes the carbide.

On removing the carbide from the furnace the material around it will fall into place between the electrodes ready to be acted upon, and the electrodes are again brought together and the current turned on, and the operation is repeated. Fresh supplies of the mixed carbon and lime are thrown into the top of the furnace from time to time as required, to replace that which has been converted into carbide. If desired the top of the furnace may be closed with a cover loosely laid on and perforated to permit the escape of the gases generated. This is not, however, necessery, as the mass of pulverized material in the furnace at any time is sufficient to protect the mass of hot carbide in process of formation from the effects of the atmosphere.

I have shown in the drawing a sectional view of an electrical furnace having horizontal electrodes which may be used in carrying my invention into effect. *A* indicates the furnace, having horizontal electrodes *B B*. *C* indicates the mass of pulverulent material with which the furnace is filled, and *D* a body of carbide in process of formation, between the electrodes.

In operating the furnace, which is first filled with a mass of pulverized carbon and lime, intimately mixed together in proper proportions, the current is turned on, when the electrodes *B B* are so nearly in contact that current will pass, and the electrodes are then gradually drawn apart as the material between them is reduced by the intense heat generated by the passage of the current through the material, which serves as an imperfect conductor. When the electrodes have been drawn back nearly to the walls of the furnace, the current is shut off, and when the carbide formed, which is at first in a fused, semi-liquid state, has sufficiently hardened, it is withdrawn from the furnace with hooks or grappling tongs, or in any convenient manner. The pulverized material which lies immediately adjacent to the mass of carbide formed will stick or be smelted thereto, forming a thin coating or shell which will protect the carbide from the moisture of the atmosphere, while the material outside of this will be heated to a point which renders its subsequent reduction more easy than when it is cold. On the removal of the mass of carbide formed, the surrounding material falls into place between the electrodes, which are then again brought together, and the operation is repeated as often as required.

Any convenient means for separating and bringing together the electrodes may be employed, and any convenient or well known form or size of electric furnace may be used, so long as the electrodes occupy a substantially horizontal position. Nor is it essential that both electrodes shall be movable, as one of them may be fixed and terminate on the inside of the furnace at or near the wall thereof, and their separation be effected by moving the other. In forming the mixture to be treated, any form of carbon, such as coke or coal, may be employed and unslaked lime of good quality should be used. These are used in the proportion of about 12 parts of carbon to 20 parts of lime, and they should be finely pulverized and intimately mixed together, so that waste of the material may be avoided, and all of it used in the production of carbide.

What I claim as new, and desire to secure by Letters Patent, is:

The hereinbefore described process of making carbide of calcium, which consists in causing current to pass between horizontally disposed electrodes, embedded in a mass of pulverized and intimately commingled lime and carbon, of such extent that a material proportion thereof will remain undecomposed by the passage of the current and gradually separating the electrodes as the material between them is reduced, so as to produce between the electrodes a body of the carbide surrounded by an undecomposed mass of the pulverulent mixture.

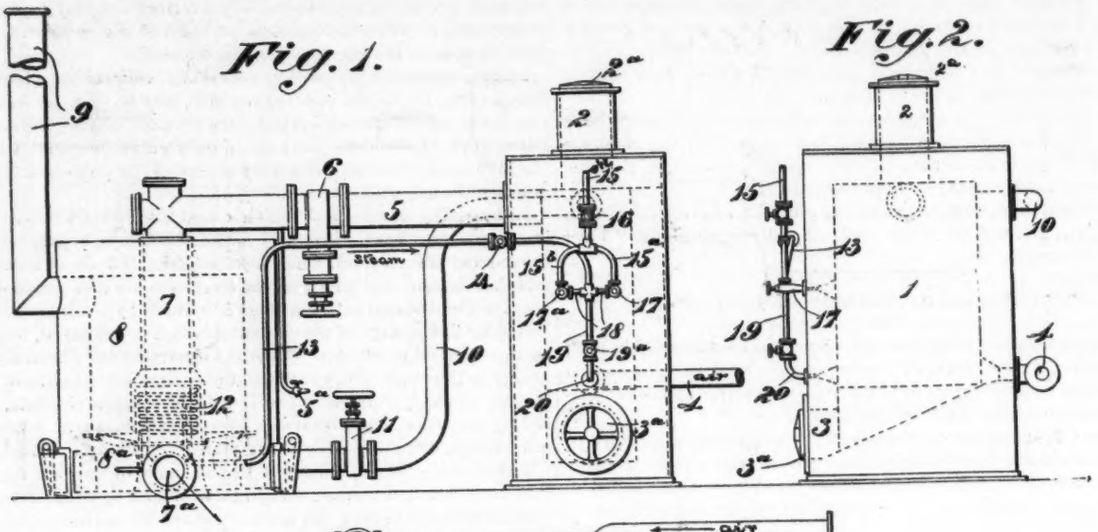
## Lewes Process of Gas Manufacture.

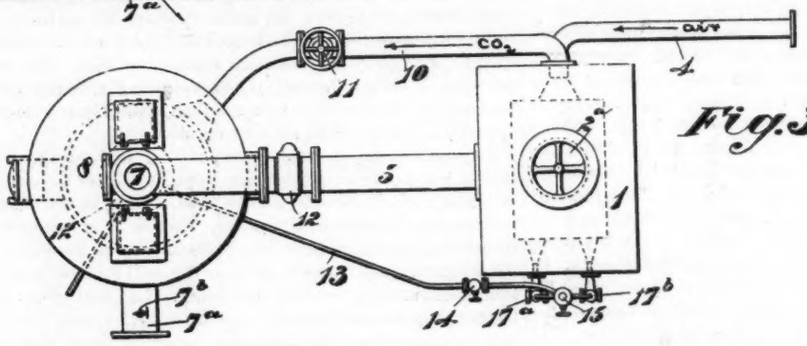
United States Letters Patent (No. 551,903), dated Dec. 24, 1895, have been granted to Prof. Vivian B. Lewes. Using the words of the specification—

This invention relates to improvements in the method of "cracking" or decomposing liquid hydrocarbon of considerable density, such as crude petroleum and tar, so as to produce therefrom combustible permanent gases of high illuminating value, and which may be used by themselves or for enriching coal gas, or for carbureting water gas, hydrogen or other non-luminous gases.

In the process heretofore proposed to be used for decomposing crude oils, so as to obtain from them gases of high illuminating value, the deposition of carbon and pitch has been so great as to rapidly choke the retorts and tubes or superheating chambers used in the manufacture, and when it has been attempted to decompose the oils by allowing them to flow by gravity into a mass of incandescent or red-hot fuel the decomposition has been carried too far, so that the hydrocarbon gases valuable for illuminating purposes have been decomposed into others of low light giving power.

Now I have discovered that when hydrocarbon of the kind mentioned is injected by superheated steam at considerable pressure into incandescent fuel within a suitable vessel, such as a gas producer or generator, the steam will attack the incandescent carbon of the fuel, forming water gas, which will so protect and dilute the vaporizing hydrocarbon that the decomposition thereof will be arrested before it has




gone too far, and as a result a permanent gas of high illuminating value will be obtained, while the carbon and pitch deposited from the hydrocarbon on cracking will remain with an increased quantity of fuel in the gas producer or generator, instead of choking the apparatus, as heretofore. A small additional quantity of steam may be injected into the incandescent fuel at a point below that at which hydrocarbon is injected by the superheated steam. Such additional steam, by becoming converted by the incandescent fuel into water gas, serves to sweep up the hydrocarbon and drive the gas out of the fuel.

In the accompanying drawings, Fig. 1 is a side elevation, Fig. 2 is an end elevation, and Fig. 3 a plan, of apparatus suitable for producing illuminating gas from hydrocarbon oils and hydrogen according to my invention. Figs. 4, 5 and 6 are similar views of Figs. 1, 2 and 3, respectively, illustrating a modified construction.

Referring to Figs. 1, 2 and 3, 1 is a gas generator comprising an outer metal casing lined with refractory material and provided with inlets 2 for fuel and outlets 3 for clinker, these openings being normally closed by doors 2a and 3a respectively.

4 is the pipe through which air can be blown into the lower end of the chamber 1 of the gas generator.

5 is a pipe with valve 6 connecting the top of the generating chamber with the top of an iron fixing retort 7, which may be used in connection with the gas generator 1. This fixing retort is located within a suitable furnace or combustion chamber 8 (hereinafter referred to as a "superheater furnace"), having an exit flue 9.

7a is the outlet of the retort.

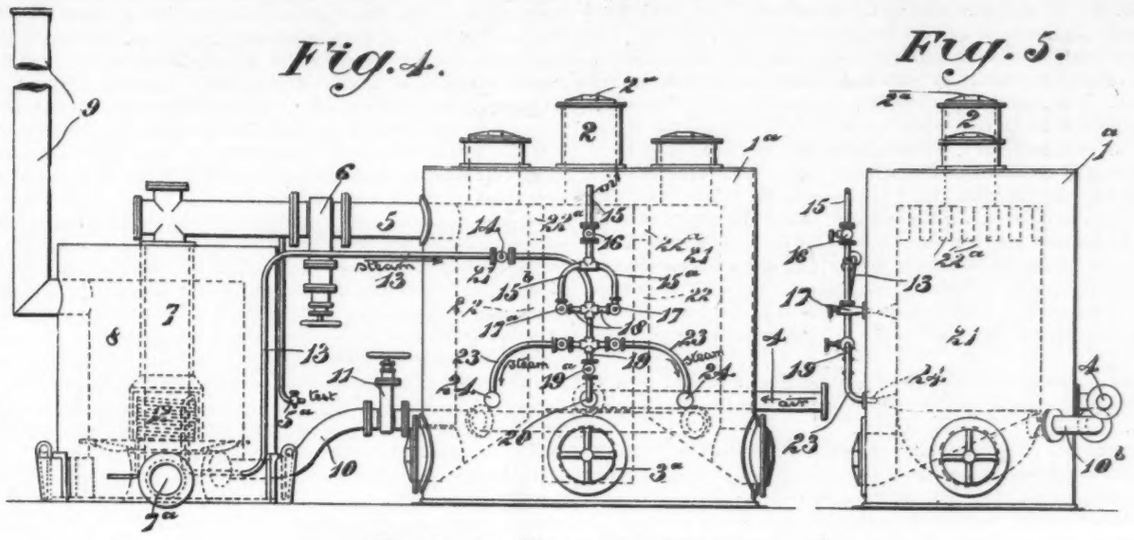
10 is the pipe connecting the generator, and is provided with the valve 11, and opening into furnace 8, below the grate bars thereof.

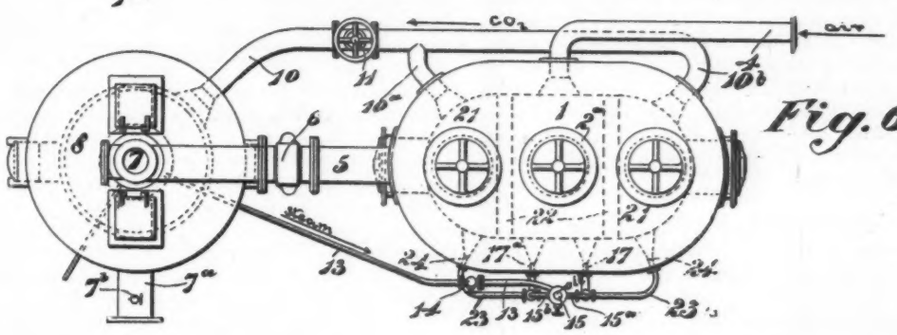
12 is the steam superheating coil (hereinafter referred to as a "superheater") that may be cast in the wall of the retort or be imbedded in the thick mass of iron or other suitable material to prevent its being burned out. This superheater is connected with a suitable steam generator (not shown) and with a steam supply pipe 13, provided with a cock 14.

15 is the hydrocarbon supply pipe provided with cock 16 and with branches 15a and 15b, that are connected respectively with two injectors, 17, 17a. These injectors may advantageously be arranged to discharge liquid hydrocarbon into the incandescent fuel in the gas generator 1 at a point about midway in the height of the said gas generator, as shown. The steam supply pipe 13 is connected by branches 18 with the two injectors 17, 17a. It is also connected by a branch 19, having a cock 19a, with the nozzle at 20 located near the bottom of the chamber 1 of the gas generator

The mode of working and the action of the apparatus are as follows: Carbonaceous fuel, such as coke, is introduced into the gas generator 1, and raised to incandescence by the blast of air forced through the pipe 4 from a suitable blower. The products of combustion, largely consisting of carbon monoxide and nitrogen, are led through pipe 10, past the valve 11, which is then open to the superheater furnace 8, the combustion of solid fuel in which is supplemented by the combustion of the carbon monoxide in the said products. By this means the fixing retort 7 and superheater 12 are heated to the required temperature. The air blasts are then cut off, the valve 11 closed and the steam and liquid hydrocarbon supply turned on. Steam under pressure is then driven through the superheater and into the pipe 13, whence it passes through the injectors 17, 17a, into the incandescent fuel in the gas generator, spraying in at the same time liquid hydrocarbon, which is fed to the injectors through the supply pipe 15.

I have obtained satisfactory results by injecting hydrocarbon, such as crude petroleum and also tar, by means of steam at a pressure of about 120 pounds to the square inch, and heated to the temperature of about 400° C. (732° F.) By thus injecting hydrocarbon into a mass of incandescent fuel it is "cracked" to gas, any carbon, pitch or the like that may produce merely adding to the fuel in the gas generator, while "over-cracking" is prevented by the simultaneous generation of water gas from the steam used in injecting. The gas thus formed flows from the top of the generator through the pipe 5 and valve 6, which is then open, to the fixing retort 7, and this being kept at approximately constant high temperature of, say, about 1,000° C. (1,832° F.), uniformly fixes the gas so as to produce a permanent illuminating gas. The resulting gas, owing to the dilution by hydrogen and the interactions between carbon monoxide and the nascent hydrocarbons in the chamber 1, contains but a small and practically harmless percentage of carbon monoxide. Steam from time to time may be also injected through the nozzle 20 into the incandescent fuel in the gas producer 1 at a point below that at which the liquid hydrocarbons are being cracked, so that in case of overheating and at the end of each run or at other times, as may be desired, the hydrocarbon in the gas generator may be swept




out by the uprush of water gas produced by the decomposition of the steam thus injected.

The production of gas in the manner described may advantageously be continued until the temperature of the fuel in the gas producer has fallen below the required point, and then steam and liquid hydrocarbon should be shut off and the various connections be adjusted as before for the passage of the air blasts in order to again raise the fuel in the gas generator to the desired degree of incandescence.

To enable the fuel in the gas producer 1 to be raised to a suitable state of incandescence in a quicker and more uniform manner than has heretofore been usual, the said gas producer is or may be constructed with additional air inlets arranged at a point or points in the generator above the inlet 4 at the bottom of the gas producer, so that two or more blasts of air can be injected into the fuel simultaneously at different points in its height. This arrangement of air blasts may advantageously be used in connection with gas producers for producing gas or other than oil gas—as, for example, water gas.

The relative quantities of steam and hydrocarbon admitted through the injectors into the incandescent fuel should be so regulated that the gas generated in the fuel chamber 1 shall be of a brown color. This may be determined by providing the gas pipe 5 with a jet cock 5a and an outlet 7a with the jet cock 7b, through either or each of which small quantities of gas can be allowed to escape from time to time. If the gas thus allowed to escape through either jet cock be white, it indicates that the hydrocarbons are not sufficiently cracked and the proportions of steam should be reduced. If the gas be black and "sooty" it indicates that they have been over cracked and the proportion of steam should be increased.

When it is desired to produce carbureted hydrogen containing but a small and practically harmless percentage of carbon monoxide, the gas produced by cracking liquid hydrocarbon in the manner hereinbefore explained is, according to this invention, diluted to the desired extent by admixture with hydrogen simultaneously produced in a separate generator by the action of steam on heated iron.

Figs. 4, 5 and 6 are similar views of Figs. 1, 2 and 3, respectively, illustrating a modified arrangement of the apparatus suitable for producing carbureted hydrogen. In this arrangement there is a chamber 21 at each of two opposite sides of the gas generator 1, formed by constructed and internally lined casing 1a, with two vertical partitions 22 of refractory material, which may extend to within a short distance of the under side of the top of the casing, or which may, as shown, be provided with a number of openings 22a that serve to place all of the chambers in communication with each other at the top and through which gas can flow. The chambers 21 serve to contain iron or a suitable compound or compounds of iron, such as sulphate of iron or oxalate of iron, that is or are capable of being readily decomposed by heat into oxide of iron, which is subsequently reduced to a metallic state by the passage over it of carbon monoxide present in the products of combustion that are produced in the gas generator when raising the fuel therein to incandescence by the air blasts. In this arrangement also the pipe 10, instead of being connected to the upper end of the oil gas generator 1, is provided with branches 10a and 10b, by which it is placed in communication with the lower ends of the chambers 21, to which are also connected steam pipes 23, that are provided with nozzles at 24 and are connected with the steam supply pipe 13 by the branch 19. The mode of working and the actions of this modified arrangement of apparatus are as follows:

Carbonaceous fuel is raised by incandescence in the generator 1 by the blast or blasts of air, as before; but the products of combustion, largely consisting of carbon monoxide and nitrogen, instead of passing direct into the pipe 10 and superheater furnace, as before, are led thereto through the openings 22a and the chambers 21 containing iron compound or compounds thereof. In this way not only will the fuel in the generator 1 and fixing retort 7 and the steam superheater 12 be heated to the required temperature, but the iron in the chambers 21 will also be heated to the required temperature to decompose steam, while if the iron be present as a compound of iron it will be decomposed and reduced to a metallic state. The air blast or blasts being then cut off and the proper connections open, the steam under pressure is allowed to flow through the superheater 12, as before, and into the pipe 13, whence part passes by the branches 19 and 23 into the chambers 21 containing the heated iron, wherein it is decomposed, liberating hydrogen, while another part of the steam passes through injectors 17 17a into the incandescent fuel in the gas generator 1, so as to spray in liquid hydrocarbon admitted through pipe 15, which is decomposed into gas, as before. Steam may from time to time be also injected through the nozzle at 20, as and for the purpose hereinbefore mentioned. The gas produced, as described, in the gas generator 1 meets at the top thereof

the current of hydrogen generated in the chambers 21 and flows therewith through the gas main 5 to the fixing retort 7, and this being kept at an approximately constant high temperature of, say, about 1,000° C. (1,832° F.), as before, uniformly fixes these gases so as to produce a permanent gas. The resulting gas, owing to the dilution of hydrogen and the interactions between the carbon monoxide and nascent and hydrocarbon in the gas generator 1, contains but a small and practically harmless percentage of carbon monoxide, as before stated. The productions of carbureted hydrogen continue until the temperature of the fuel in the gas generator has fallen below the required point. The supply of steam and the hydrocarbon are then shut off, and the various connections are adjusted as before for the passage of the air blast or blasts, any traces of hydrocarbon remaining in the said gas generator assisting the carbon monoxide to reduce to a metallic state the iron that has been oxidized in the chambers 21 by the steam ready to repeat the foregoing operations.

The relative quantities of steam and hydrocarbon admitted into the incandescent fuel should be determined in the manner hereinbefore explained.

I am aware that it has heretofore been proposed to produce illuminating gas from crude oil, such as crude petroleum, by injecting the oil by the steam through red hot tubes, chambers or retorts; but this method has not been successful, because the steam has injuriously attacked the oil, whereas by injecting the oil by steam into incandescent fuel the steam attacks the incandescent carbon in the fuel in preference to the oil, with the result that permanent gas of high illuminating value can be obtained when carrying out the process on a large scale. It may be made a continuous one by employing two sets of apparatus of the kind hereinbefore described, so arranged and operated that illuminating gas will be produced in one apparatus while fuel is being raised to the state of incandescence in the other, and vice versa.

What I claim is:

1. The herein described method of manufacturing illuminating gas, which consists in simultaneously blowing a bed of fuel to incandescence and a body of iron to a decomposing heat, then cutting off the blast and forming hydrogen gas by injecting steam into the body of iron and producing carbureted hydrogen gas by injecting oil and steam into the body of incandescent fuel, combining said hydrogen and carbureted hydrogen gases and conducting the same through a heated fixing chamber and finally passing steam alone through the body of incandescent fuel, substantially as described.

2. The herein described method of manufacturing illuminating gas, which consists in blasting a body of fuel to incandescence and at the same time heating a bed of iron to redness, then injecting oil and steam into the body of incandescent fuel to form carbureted hydrogen gas, and at the same time injecting steam into the bed of iron to form hydrogen gas, combining said carbureted hydrogen and hydrogen gases and passing the same through a heated fixing chamber, substantially as described.

3. The herein described method of manufacturing illuminating gas, which consists in blasting a bed of fuel to incandescence, and a body of iron to a decomposing heat, then injecting oil and steam into the body of incandescent fuel to form carbureted hydrogen gas and injecting steam into the bed of iron to form hydrogen gas, and finally combining said carbureted hydrogen and hydrogen gas at the point of generation, substantially as described.

## Moving Two Thirty-six-Inch Water Mains Without Shuting Off the Water.

By E. C. Moore, Jun. Am. Soc. C. E.[1]

The Metropolitan Street Railway Company of New York secured the franchise for a cable road through Lexington avenue, from Twenty-third street north to the Harlem river, and the author has been the division engineer in charge of its construction. The fact was recognized early that one of the most serious difficulties to contend against was presented by the substructures already in the street. With this fact in view an attempt was made to get an accurate record of exactly what was in the street, by looking up the maps and records of the various gas companies, the city water department and the subway company.

The maps of the gas companies were thoroughly unreliable as to location, as was also the water map; those of the subway company were a little better, but not infallible, so at an early stage in the construction these maps were entirely discarded and no calculations were made for the moving of obstructions until they were actually encountered in the work. It was found more convenient and less expensive to move obstructions after the excavation had been completed, and the extra expense of a second digging was saved. More obstructions were encountered at intersecting streets than elsewhere, and it was frequently necessary to move two or three outlying pipes or subways in order to get the room required for moving the one which was in the way.

While this system worked very well on Lexington avenue, where there were no cars to be taken care of on side tracks, it would not answer when the work was extended through Twenty-third street, where there were not only a large number of cars to be taken care of on the side tracks, but a heavy traffic through the street as well. Moreover, the business houses along the line had to have entrances to handle their wares. Provision was also made for two cables for Twenty third street proper, in addition to the Lexington avenue cables, and the construction problem was therefore a complicated one. All the mains which were parallel to and within the tracks already in use were replaced by new mains, laid on the outside, and in some cases new mains were laid on one side of the street, when there was already a main on the other side, in order to get rid of the house connections, which usually ran too high for the cable construction.

The success of these operations was encouraging and furnished ground for the belief that it would be possible to move two 36-inch water mains in Broadway, between Twenty second and Twenty-third streets without shutting off the water, which would not be permitted by the Department of Public Works. These mains were laid in 1839, and had joints every nine feet.

It was decided that the pipes, which had to be dropped a maximum distance of 2 feet and moved laterally 1 feet, should be lowered by chains and turn-buckles swung from yokes placed over them at each joint. The yokes were made of 8 x 12 inch yellow pine, the posts being 8 feet 6 inches long, set on a wooden foot block of 5 x 12 inch yellow pine 2 feet long, and the cap piece was about 11 feet long, being 9 feet between the posts.

The posts were sawed off square, and, after they were set up in place, the cap piece was laid on top of them without framing, then cap and post were fastened together by a cleat of 2 x 9 inch spruce about 2 feet long, which was nailed to their sides, one being used at each post and on opposite sides of the bent. Then two diagonal braces about 3 feet long of 2 x 9 inch spruce were nailed diagonally from the cap piece to the opposite side of the post.

As soon as the first bent was set up and braced from the ground, the next bent was set up, and the two were fastened together by nailing two pieces of 2 x 9 inch spruce on top, reaching from one bent to the other at the ends, and so on until 20 bents were in place.

Then the chains, which were of ¾-inch round iron with links 7-inches long on the inside, were put in place (see cut). The chain which went over the yoke was 5 feet long, and that which went around the pipe was 11 feet long. There were two turn buckles at each bent, so that the chain would not have to slip around the pipe or the timber in lowering. Each turn-buckle was of 1¼-inch iron, with hooks on each end, and could lower 12 inches without changing hooks. The hooks were made to just fit in the links of the chain, and when the pipe was dropped as far as the turn-buckle would go, each turn-buckle was taken off in turn and the hooks placed in links nearer the end of the chain, when the lowering proceeded as before. Everything was made of sufficient strength to allow of every other turn-buckle being taken entirely off without blocking the pipe. This proved of great advantage, as much time would have been lost if it had been necessary to lower the pipe down on blocks in order to change the turn-buckle.

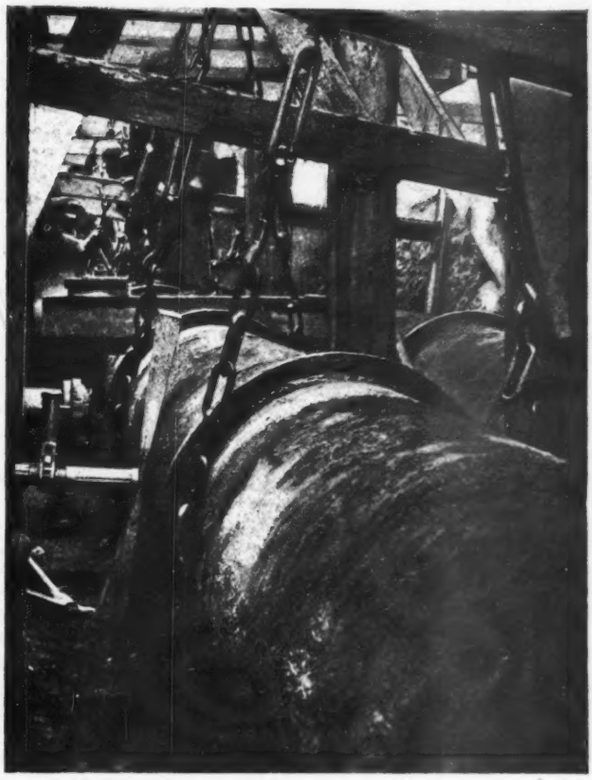
When the lowering of the pipe began, it was decided to move it sidewise at the same time. This was accomplished by hanging the chains over the cap piece a few inches to one side of a perpendicular through the center of the pipe, and putting a brace of 4 x 6 inch spruce from the end of the cap pieces to the bank, to prevent the carrying over of the top of the bent toward the pipe, instead of the desired movement of the pipe in the opposite direction. At the same time, a brace of 2 x 9 inch spruce was added at each end of each bent, running diagonally down from the top of one bent to the bottom of the next, and in opposite directions at the opposite ends of the bents. This was to take care of the torsional strain caused by the cap piece being at right angles to the pipe. By moving the chains along the cap piece a few inches at a time, it was found that when the pipe was down it was exactly in position sidewise also.

By beginning at one end, it was possible to lower the first 100 feet of the pipe into position, and to take down and move ahead the first eleven bents; then, as the pipe came into position, each bent was taken down and moved ahead again. The two pipes lay parallel to each

1 Read before the Am. Society of Civil Engineers.

other and 5 feet apart from center to center. One pipe was lowered at a time. There was one hydrant connection on each pipe; this was cut off outside its gate, and a clamp of wood was fitted around the pipe and a long arm attached which reached out to the cut in the connection, and gave it support at that point. Clamps were put around the joints in the hydrant connections to prevent any possibility of their blowing out.

It was found that almost no calking was necessary during the lowering of the pipes; there were occasional small leaks, but they generally stopped themselves as the pipe was lowered and the joint had a chance



to come back into place. It was thought desirable to do no more calking on the pipe than was absolutely necessary until the work of lowering was entirely finished; then all the joints were gone over and put in good condition.

As it was desired to push the work as fast as possible, a connection was made with an electric lighting cable, and 8 arc lights and about 20 incandescent lights were set up, and the work proceeded night and day. Excavation began on June 19th, and the work of putting in the bents over the mains began on June 22d. Both pipes had been moved and were in place June 29th, and within another week the trench was filled and paved over, except where the line of the excavation for the cable tracks crossed.

The pipes were moved the extreme distance for 100 feet, and 100 feet was allowed at each end of this distance for the gradual swing, so as not to strain the joints too much by short bends. This made a total length moved of about 300 feet for each pipe.

The approximate cost of the moving was about as follows:

| | |
|---|---|
| 40 1¼-inch turn-buckles with hooks on each end. | $102 40 |
| 320 lineal feet ⅝-inch B. B. chain, 7-inch links.. | 102 95 |
| Lumber, including bridging and wedges..... | 298 74 |
| Electric lights..... | 175 00 |
| City inspectors..... | 463 62 |
| Engineers ..... | 109 00 |
| Labor, carts, etc..... | 4,250 00 |
| Total..... | $5,501 71 |

The foregoing cost may be considered somewhat high, but while the main object sought was the completion of the work in the shortest possible time, every effort was made to avoid unnecessary expense. Night work adds very materially to the cost of such undertakings, because a man cannot do as much work at night as in the day time, and there is also more opportunity to shirk. The cost of providing lights and other conveniences and safeguards must be considered.

*Discussion.*

Mr. Edward Wegmann, Jr., M. Am. Soc. C. E., stated that there were other cases than those mentioned in the paper in which 36-inch mains in New York City had to be shifted and lowered to a considerable extent.

When the old Croton Aqueduct was constructed, the masonry conduit terminated at a receiving reservoir located in what is now Central Park. From here two lines of 36-inch mains, laid in Eightieth street to Fifth avenue, and then down this avenue, conveyed the water to a distributing reservoir at Forty-second street. After the mains had been laid, changes were made in the grades of Fifth avenue, which necessitated the lowering of the pipes at some points. The first case of this kind occurred in 1850, at Murray Hill, near the distributing reservoir. At this place the pipes had to be lowered 16 feet. The Commissioners of the Croton Aqueduct Department decided at first to remove the mains until the avenue had been excavated to the new grade, and then to relay them. If this had been done, the only connection between the receiving and distributing reservoirs, for the time being, would have been a line of 30-inch mains that had been laid the preceding year in Third avenue. Mr. E. W. Tracy, one of the engineers of the Aqueduct Department, who subsequently became chief engineer of the Croton Aqueduct, proposed a practical plan for lowering the pipes in place, which was accepted and successfully carried out under his direction.

At the place in question the material to be excavated was hard pan. Small drifts, located about 8 feet apart, were excavated under the mains. In these drifts blocking was placed to support the weight of the pipes. After this had been accomplished the material remaining between the drifts was excavated. By using jack screws the blocking was then gradually removed and the pipes lowered to the new grades, the additional length being obtained by the pipes drawing a trifle out of the joints. Only one line of mains, from which the water was shut off, was operated on at a time, the other line being kept in service.

Another case of this kind occurred in 1856, on Fifth avenue, between Forty-seventh and Fifty-fourth streets. In this instance the two lines of 36-inch mains were lowered a maximum distance of 11 feet without the water being shut off from either line. As the excavation had to be made in solid rock, the pipes had first to be shifted to one side. This was accomplished after the avenue on the east side of the mains had been excavated to the new grades, by placing under the pipes wooden saddles that rested on greased skids. The mains for a length of 1,300 feet were then moved over to the east, by means of jack screws, a maximum distance of 10 feet. After a pipe trench had been excavated in the middle of the avenue, the pipes were moved back to blocking which had been placed in this trench. The lowering of the mains was then accomplished in the manner explained in the first case. During the shifting and lowering of the pipes but very little caulking of the joints was required. The work described, which attracted considerable attention at the time, was performed under the direction of the late James P. Kirkwood, Past President Am. Soc. C. E., subsequently chief engineer of the Brooklyn Water Works.

In 1870 the two lines of Fifth avenue mains had to be lowered between Sixty-eighth and Seventy-second streets a maximum distance of 4 feet. The work was performed successfully under the direction of Gen. George S. Greene, Past President Am. Soc. C. E.

Mr. James Owen, M. Am. Soc. C. E., though having had no experience in moving large water mains, had lowered many small pipes without shutting off the water. The first he undertook to move was an 8-inch main that was to be dropped a number of feet. Elaborate preparations were made for doing the work slowly and uniformly, but at the last moment something gave way and part of the line of pipe fell to the bottom of the trench. It was with considerable anxiety that he descended to examine the condition of the main, but when it was found to be intact and tight, he experienced a change of feeling, and has ever since felt confident of success in such undertakings.

Mr. Joseph C. Platt, M. Am. Soc. C. E., said that during the summer of 1894 one of the 36-inch pipes of the Brooklyn Water Works was uncovered and a 12-inch hole cut on one side in order to connect a pipe of that size with it. This 36-inch pipe was one of the original mains of the system. It was made in Scotland and laid as early as 1859, and was probably well covered with the genuine Dr. Angus Smith's coating.

The piece which was removed was free from tubercules, pitted holes and all other evidence of deterioration.[1] In fact, it appeared as good

1 This piece is now (October, 1895) on exhibition at the office of the Water Purveyor of Brooklyn.

as many lengths which have lain in a pipe yard for a year. The iron was strong and clean, a good pipe or machinery iron, and quite different from much that is of later date.

It has been stated by those in charge of the Ridgewood station of the same water works, where the water is pumped before it runs through these 36 inch pipes, that the pump cylinders and chambers handling this water are so deteriorated that the iron will not hold a tap bolt, but that it is necessary to use bolts running through the metal and a packed washer on the inside, whenever it is desired to make an attachment to the parts in question. The speaker did not attempt to decide whether the great difference in the lasting qualities of the two irons was due to the fact that the pipes were coated and the machinery was not, or to a difference in the metal originally, or to the frequent vibrations of the pumps, from which the pipes are free, or some other cause.

## Address of President Herbert Lees, before the North of England Gas Managers' Association.

Gentlemen—The position to which you elected me at your last annual meeting is one which I should be unworthy to occupy if in any degree I was lacking in appreciation of the honor conferred upon me. I again thank you for the confidence you then reposed in me; and if the Association should in any sense suffer by the selection you have made, I can assure you that it will not be for want of effort, so much as of ability, on my part to maintain the prestige to which it has now attained. I am deeply sensible of the responsibility attaching to the office; and when I look back upon the long line of my predecessors, many of them men of eminent ability, you will not be surprised if at times I have had misgivings. I know, however, that I can rely upon the sympathy and support of the general body of members, who have always proved their loyalty to those gentlemen they have elected to this and other official positions.

As one of the younger members of the Association, I should like to urge those of my own class to take a more practical interest in its affairs. This is a matter which ought to need no pressing. Within recent years many have joined our ranks who are capable of increasing the usefulness of the Association; and I hope that during my year of office some of this latent talent will be developed, either by contributing papers or in discussion. Let it not be inferred from these remarks that it is thought that all the wisdom and experience is "bottled up" in the the youth of the profession. We should greatly regret—and it would be an irreparable loss—if the men of ripe experience should abate their interest one whit, or in any sense relax their efforts to advance the objects of the Association. It is not necessary that one should give place to the other, but rather that the younger members should emulate their seniors, and they in turn lead us on to greater triumphs than have yet been accomplished, and thus still further enhance our position among kindred societies.

The duty which more particularly devolves upon me at this point—namely, that of placing before you material for thought and consideration on questions of a technical or administrative character relating to the manufacture and distribution of coal gas—is one that does not get easier as the years revolve. We are so well supplied with technical journals that nothing of interest to the gas engineering profession is allowed to escape notice therein; and so many presidential addresses and other communications are written every year that it seems next to impossible to advance a new idea, or clothe an old one in new language. I am not in the fortunate position of being able to unfold to you the details of some new invention which is destined to revolutionize the gas industry, and make the electric light sink into pale insignificance before the brilliancy of our future prospects; nor am I pessimistic enough to suggest to you the extreme course of making serious preparation for adopting some other means of obtaining a livelihood. I hope, however, that I shall, before closing my remarks, be able to give some tangible evidence of the advance that has been made, and of the reasonable expectations to which we may look forward.

*Progress in Hexham.*—It will, perhaps, not be out of place if some reference should be made by me to the undertaking with which I am connected, and the works you have had an opportunity of seeing to-day. The history of the gas supply of Hexham dates back for a period of over sixty years; and during that time the undertaking has passed through many vicissitudes. It is, however, many years since it was established on a sound basis. From that period its record has been one of steady progress; and it now occupies a prominent position among the smaller gas companies of the North of England as a means of investment. This result has been achieved, not by methods which are foreign to other gas companies, but by the application of those principles which contribute very largely to all successful undertakings of a similar character.

At a comparatively early date, the question of utilizing gas for purposes other than lighting was prominently brought before the consumers, by means of an exhibition of gas appliances; and from time to time this has been supplemented by smaller exhibitions and cookery lectures, and a free use of the literature so familiar to all of you. The result is that during the past eleven years—without any increase in the population of the town—the gas consumption has grown to the extent of 80 per cent.

The number of appliances in use for purposes other than lighting is as follows: Cookers, 132; grillers, boiling rings, etc., 129; gas fires and heating stoves, 91; gas engines, 9—making a total of 361. The total number of consumers is 866.

In addition to the development shown by these figures, there has been a decided improvement in the illumination of shops and private houses, although there is room for further advancement. In some cases this has been brought about at a reduced cost. I wish it were possible to record a corresponding advance in the public lighting of the town. The increased consumption referred to will seem more important when I tell you that in the previous twelve years there was a growth of 196 per cent., making a total increase in twenty-three years of 433 per cent.

Rather more than two years ago a further advance was made when the penny in-the-slot system of supplying gas was introduced; and although we have not been able to obtain so large a consumption per consumer as is reported from some towns, the system has fully justified its adoption. As from the first we have supplied the fittings and a griller—and in some cases a small cooker—it has also become an advertising medium for cooking by means of gas.

It is not possible for us to do too much in the way of advertising and of educating our consumers, only our advertising should be judicious and persistent. I have no novel method to offer you. My plan is to keep in touch with the consumers as much as possible, and see that they are well supplied with literature; and if some of this should find its way into the waste paper basket, not to be discouraged, but send more.

*Lectures—Meter Rents.*—I am of opinion that we ought, not only as individuals but as an Association, to do more in the way of arranging popular lectures on methods of illumination and other means of utilizing gas. As an Association we have done nothing in this matter outside the limits of our ordinary meetings; but is it not possible to arrange for a series of of lectures to be given in various towns during the winter months? While it would be impossible for many of us to prepare a course of lectures, in addition to the worry and strain of a winter's work, it might not be too much to take up one phase of the question; and, by arrangement, interchanges could be made, so as to give a full course in a given town. If such a scheme could be adopted I believe it would receive the sympathy and support of the proprietors of gas undertakings, and could not fail to be beneficial in its results. It would be fallacious to suppose that all this would tend to bring "grist to the mill," unless the internal administration of the concern was of a popular character. We want, as far as possible, to remove those relics of a bygone age which, under the guise of safeguards, are really obstacles to the development of business.

If it should be necessary to adopt or retain the deposit system at all, let it be only as a safeguard, and not be applied all round as a mere matter of red-tapeism. Then there is the question of initial charges before a person can become a consumer. It has been the custom here for a good many years for the Company to bear all charges for service pipes and meter fixing, unless under very exceptional circumstances as to distance. This I believe to be of far more importance than the abolition of meter rents; and yet there are some who concur in the payment of at least a certain portion of these outlays, and at the same time talk of the system of charging meter rents as unjust, and injurious to the development of consumption.

This question of meter rents has been invested with an importance far beyond its merits. It has served many an embryo town councilor with an election cry; and if we could trace its origin it would probably be found to have made its debut on some platform at a ward meeting, during one of those annual campaigns which take place in our boroughs about the end of October. It has, however, passed beyond this stage; and now that the largest gas company in the world has included this abolition in its policy, others will no doubt be not less slow to adopt it. I am bound to say that, in my experience, I have never found the meter rent to be an obstacle to the growth of gas consumption; but I have frequently met with complaints of charges for fixing meters. But how would the change affect our consumers? We know that it would make little or no difference to the shareholders. If meter

rents are abolished the price of gas will be maintained to give the equivalent. The result will be that one consumer will be benefited at the expense of another. The following table will show how the question will apply to Hexam:

TABLE I.—*Ratio of Meter Rents to the Consumption of Gas at Hexam.*

| Consumption per Annum. | No. of Consumers. | Total Consumption per Annum. | Average Consumption per Annum. | Total Meter Rents. | Meter Rents per 1,000 Cu. Ft. |
|---|---|---|---|---|---|
| Cubic Feet. | | Cu. Ft. | Cu. Ft. | | Cents. |
| 5,000 and under ..... ... | 146 | 373,200 | 2,555 | $79.83 | 20.54 |
| Above 5,000 and below 10,000 | 123 | 814,800 | 6,624 | 75.93 | 9.94 |
| " 10,000 " 25,000 | 182 | 2,866,600 | 15,750 | 125.00 | 4.18 |
| " 25,000 " 50,000 | 65 | 2,236,700 | 34,411 | 53.00 | 2.26 |
| " 50,000 ... ..... | 72 | 6,845,900 | 95,082 | 96.12 | 1.34 |
| Consumers using own meters | 133 | 6,958,800 | 52,322 | ..... | ..... |
| | 721* | 20,095,800 | 27,872 | $429.88 | 1.82 |

* Prepayment consumers not included.

It will be seen by a glance at this table that the 146 consumers who are the least lucrative under present circumstances would receive a most abnormal concession—equivalent to a reduction of 20¼ cents per 1,000 cubic feet—if meter rents were abolished; while the 72 consumers of 50,000 cubic feet per annum and upwards, and the 133 who provide their own meters, and who are the mainstay of the Company's consumption, would have to pay at a higher rate to meet this. This is contrary to the accepted principles upon which business is conducted.

These small consumers are not by any means confined to the working class, but are largely composed of tenants of offices and small lock-up shops, where it is convenient to have gas in readiness, and where, unfortunately for us, it is seldom used. The abolition of meter rents would mean the removal of many of these consumers from our books, otherwise they would be retained at a distinct loss. I am afraid the subject has not received the careful consideration it deserves, and where public opinion may have appeared to influence abolition, surely it is for want of accurate knowledge, and that we ought to be in a position to supply as it affects our respective districts.

What is of far greater importance as influencing the consumption of gas than the question of meter rents is the price at which we can sell. There will always be some difference of opinion between the buyer and the seller as to what is a reasonable figure; hence none are entirely free from complaints on this head. The smaller companies probably suffer most in this respect, doubtless because comparisons are made with the larger undertakings, the circumstances of which are widely different.

*Small Economies.*—Whatever conduces to economy of manufacture or distribution of gas should receive the consideration of those responsible for such undertakings. Like other industries, we are to a certain extent subject to fluctuations in the price of raw materials, and we are also affected by the sale of residual products at our disposal. These are influences over which we have no control. Economies of manufacture naturally begin in the retort house. It has been said that profits are made or lost there; but it would be unwise to assume that it is the only place where profits are made or lost; and hence the necessity for giving the most careful attention to every detail up to the point of consumption—not forgetting the small savings, which in the end prove very important.

Some of you may, perhaps, remember a leading article which appeared about eight years ago under the heading "A Drop of Solder." This article is said to have been suggested to the writer by the story of an American workman having invented a method of wiping off the spare drop of solder which previously had been allowed to remain on the tins made for use in preserving fruits, etc. It was a little thing, but it produced marvellous results. The moral is obvious. But we might do worse than re-read that article occasionally, and if we could also get its principles firmly impressed upon every workman and member of the staff, the gas industry would be the richer for it.

We have endeavored to do something to reduce the cost of manufacture here. Rather more than two years ago we introduced the system of gaseous firing to the retorts, and last year made a further extension in the same direction, so that all the retorts are now heated by means of generator furnaces, with very satisfactory results. Coke sales have increased to the extent of about 2½ cwt. per ton of coal carbonized, equivalent to a saving of at least 31 cents per ton of coal, while the cost of carrying out the necessary alterations did not exceed $1,250. The erection of a coal store has conduced to greater safety and more comfortable working—factors upon which it is difficult to fix a money value; but they possess one, and something more. The cost of purification is kept within very reasonable limits by an adequate provision of purifying space and a good sale for spent lime. The adoption of the air process has not been entirely overlooked. Some experiments have been conducted, but the results have not yet proved satisfactory, although I have reason to believe that when the initial difficulties—probably due to local circumstances—have been overcome we shall be able to carry on purification with still greater economy, and with less nuisance from the spent lime.

Placed as we are in the center of an agricultural district, it was natural that we should turn our attention to the manufacture of sulphate of ammonia. This has proved a right step, even at the low prices that have ruled during the past season. It is somewhat surprising that farmers do not use sulphate of ammonia to a greater extent than is done at present, especially so at the prices at which it has been sold this year. Its more extended use would probably do more towards relieving agricultural depression than either bimetallism, protection, or a good many more of the remedies the State is asked to apply, in order to spare individual effort. A series of experiments carried out under the direction of Professor Somerville (the details of which are given in a report to the County Councils of Northumberland and Durham) go to prove that sulphate of ammonia and nitrate of soda are about equal in value per unit of nitrogen—*i. e.*, 86 pounds of sulphate of ammonia is as effective as a fertilizer as 112 pounds of nitrate of soda. In certain seasons sulphate produced the best results, while in others nitrate had the advantage. Therefore, when nitrate of soda was quoted at $41.25 per ton, sulphate of ammonia possessed a value of $53.75; and yet at that time the latter was selling at $46.25 per ton, and in some cases even less. We can only hope that, as the knowledge of these facts becomes more widely disseminated among the farmers than it appears to be at present, we shall to some extent share the benefit.

*Saleable Coke in* 1884 *and* 1894.—It is important that occasionally we should, in a general way, review the work of past years, mark the progress that has been made, and ascertain where it is possible to strengthen our position for the future. I have endeavored to do a little in this direction by a study of the published statistics relating to some of the principal gas undertakings in England, whose accounts are analyzed annually by Mr. Field; for progress that does not show itself on our balance sheets is not of a very satisfactory character. The advance made in economical working by these undertakings during the past ten years (the period taken) is not so great as some might expect, but it must not be forgotten that the nearer we approach to perfection in any system the slower will be the progress.

In manufacture some of the factors that have been prominent are gaseous firing, labor saving machinery and enrichment by means of oil, tar and similar liquids. With regard to gaseous firing, it must be remembered that the comparative progress made in individual works must necessarily depend upon the results previously obtained with the open furnace, and these have varied considerably in different works. It is not my intention to make comparisons between one individual works and another, but rather to show the relative positions of the works under consideration in 1884 and 1894 respectively.

The following table shows the quantity of coke sold per ton of coal carbonized for the years 1884 and 1894 respectively in the various groups of undertakings dealt with in "Field's Analysis."

TABLE II.—*Coke Sold per Ton of Coal Carbonized in* 1884 *and* 1894 (*Field.*)

| | 1884. Cwt. | 1894. Cwt. | Cwt. |
|---|---|---|---|
| Metropolitan companies.... | 9.26 | 9.47 | Inc. 0.31 |
| Suburban companies..... | 9.25 | 9.67 | " 0.37 |
| Provincial corporations... | 8.27 | 8.29 | " 0.02 |
| Provincial companies..... | 8.39 | 8.31 | Dec. 0.08 |

The improvement shown in the metropolitan companies' accounts is about ½ cwt. per ton of coal carbonized, and though this may seem small, it amounts to a saving of nearly 60,000 tons of coke per annum, which has a monetary value of about $175,000. The most striking feature of this table is the wide difference between the results obtained in and about London and those in the provinces. There may be some other explanation, but on the surface it is suggestive of the need for a further extension of gaseous firing. Possibly one disturbing element is the larger proportion of cannel used by the provincial undertakings, some of which has a very low yield of coke per ton.

Other advantages claimed for gaseous firing are the increased lifetime of the retorts and improved yield of gas per ton of coal. The latter, of course, assumes that under the old system low heats have

been the rule. In the undertakings referred to in Table II. there has not, however, been on the whole, any improvement in the yield per ton, and this would suggest that, under the present system of carbonization, we have approached the maximum results. I am, of course, dealing with averages, which infers that some are higher than others, and it should be our ambition not to be satisfied with reaching the average, but aim at the highest results. Till we have accomplished this —making a justifiable allowance for different classes of coal—we have not exhausted the resources of present-day systems.

*Labor and Wages.*—The extended use of labor-saving machinery—and under this heading I would include inclined retorts—has been concurrent with an advance in carbonizing wages, and in some degree it has been the outcome of and a safeguard against further labor troubles. The advance in wages has either been greater than the economies derived by the introduction of machinery, or a very small proportion of the coal carbonized has been dealt with in this way, and consequently the carbonizing expenditure has been on the upward grade. The stoker has within recent years had a very good "innings." But there will, necessarily, be a limit to the growth of expenditure in the matter of increased wages, and as it will doubtless be found that the stoker is paid for his work as well as, if not better, than any other unskilled laborer, we may expect that a reasonable view will be taken of the position.

It cannot truly be said that the proprietors of gas undertakings generally have not looked after the welfare of their employees. They have seen their duty in this matter and have done it, not grudgingly, but even generously in a large number of cases. Further claims for advance where anything like the maximum rates are being paid would, in all probability, bring about a more extended use of labor-saving plant, and therefore the stoker would not be the gainer. As a rule these labor difficulties are not seriously felt in small works, but that, of course, is no reason why justice should not be shown all around.

I am not able to speak from experience as to what extent stoking machinery and inclined retorts may have been an advantage, but there is no evidence in the published accounts referred to to show that the system has, as yet, had any material influence upon the cost of manufacture. There may be solitary cases where it has, but a perusal of the statistics will show that it is not general.

*Enriching Processes.*—The enrichment of coal gas by means of oil, tar, benzol, etc., has received considerable attention within recent years. We are not limited to one particular process. Many are now on the market, but perhaps the one known as the "Peebles process" has, so far, met with the greater favor. Others will, no doubt, claim the further attention of gas engineers, and their respective merits will be settled by experience.

I do not think we have yet made the most of our own product, tar, for enriching purposes. It is a substance perhaps not so easily dealt with as oil, and possibly this may have something to do with our comparative neglect of it. But the difficulties are not insurmountable, and when they have been fully met we shall have in our possession another weapon that will be useful, not only for its enriching purposes, but as an aid, to some extent, in controlling the prices of that once valuable commodity.

Benzol enrichment was ably dealt with by my predecessor in the chair (Colonel Sadler) at our last meeting, and experiments were shown as to its value and ready adaptability. The one difficulty of Colonel Sadler's method of applying benzol which was suggested to my mind is that of controlling the requisite amount of enrichment. It does not seem to me that this can be done satisfactorily by means of a by-passing arrangement as described to us. This, however, is a minor difficulty—if it is one at all—and the ingenuity of the profession is, we trust, not so far exhausted as to be overcome by it. It was my intention to make some experiments on a small scale during the summer, but a good many other duties which, of necessity, had to be performed prevented my doing so. Benzol has been used on a fairly large scale in one or two works, and, I believe, with considerable success, but as yet I am not aware that any definite figures as to cost have been published.

This question of enrichment is one that does not apply largely to undertakings supplying gas of 16-candle power or under; but even in these cases it is a question worth considering as to the possibility of using an inferior and cheaper class of coal, and improving the quality of the gas by means of liquid enrichers. With such a choice of enriching materials we should be safe against any abnormal advance in the cost.

An important point in regard to these enriching processes was clearly shown during the very severe weather of last winter. Where the processes were in use an entire absence of naphthaline deposits was experienced. Who would not have been glad to turn on the oil process during that period, to have given relief to suffering consumers? Some such silent and effective remedy would be very useful also when troublesome deposits of naphthaline assert themselves on the works. There are few of us who could not relate experiences of anxious moments over this insidious foe, and you will all agree that it is pleasanter to talk of the event when it is over than to be engaged in the conflict with such a treacherous opponent. Any process which possesses the advantage of subduing the naphthaline trouble will be looked upon with more favor in consequence.

There has been a satisfactory reduction in the proportionate amount of capital employed within recent years, and a very marked advance in the price of gas shares and stocks. In a recent issue of shares the prices realized were such as to give rather less than 4 per cent. per annum on the investment; and in at least one more instance a fraction over this amount was the result. These are factors which have an important bearing upon the general results of a gas undertaking, and may certainly be taken as signs of prosperity and confidence.

*Progress.*—When we come to the question of methods of illumination, and the prospects of gas for other purposes, we have every reason for congratulation. It is not very many years since the standard argand burner was accepted as the one which gave the best lighting result, but since then it has given place to the regenerative lamp, and this in turn has been surpassed by the incandescent burner, which gives a lighting power of about six times that of the standard argand. When consumers begin to realize the possibilities of gas lighting, and local authorities learn that it is their duty to give the ratepayers that system of public lighting which is both economical and effective when properly applied, the progress will be still greater. With such weapons as the incandescent and other burners now on the market, we have nothing to fear from the electrician; and, on the other hand, we should be able to meet our more modest—if not more powerful—rival, the oil lamp, by means of the penny-in-the slot meter.

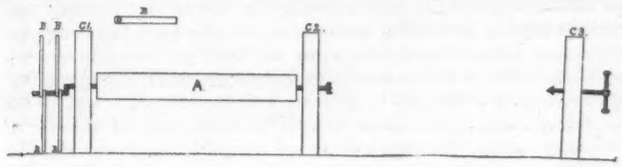
We have reason to believe there is a great future for the supply of gas for heating purposes. Professor Lewes informed his audience at the meeting of the Gas Institute in Edinburgh last June that gas heating stoves were made on the Continent which gave a heating result greatly in advance of anything we have in general use in this country. We may be sure that we shall not long be behind in this matter; and when we are in a position to supply a gas fire or stove that will be as economical as a coal fire when in constant use, there is a very wide field for further developing the consumption of gas. The demand for gas as a motive power is still on the increase; and this is a field in which electric lighting and gas engineers may find mutual ground to meet upon—probably to the advantage of both. The gas engine has made great strides, and there are still further possibilities before it.

The parliamentary returns of statutory gas undertakings in the United Kingdom show that during the past 10 years the aggregate consumption of gas has increased no less than 45 per cent. This is a result which cannot be other than satisfactory to us, and with the advantages we now possess we should be able to maintain an equally good rate of progress. In order to still further this, let us emulate each other in our efforts to produce the best possible results. The value of our meetings will be in proportion to the general improvements shown as the result of our deliberations. It should be the ambition of each one, not to be satisfied with attaining the average standard of efficiency, but to aim at the high-water mark of gas works management. I believe this ambition does exist very largely among the members of this Association; and while it is so, there is also a willingness to impart to each other any information that is likely to be of mutual benefit. Consequently the industry at large is the better for such opportunities as are given by meetings of this character.

## A Lathe in the Woods.

Mr. A. H. Rauch, Superintendent of the Bethlehem (Pa.) Gas Company, forwards the following description of a lathe suggested by an article in the JOURNAL under date of Dec. 9, 1895:

About 65 years ago there lived in Lancaster county, Pa., a house carpenter who put up a lathe in the woods for the purpose of turning wooden columns. A description of this lathe may be of interest. In the accompanying cut *A* represents the flywheel, which consisted of a rather heavy log about 10 feet long and 15 inches in diameter, with a crank driven through post $C^1$ into it at one end, and an iron with points through post $C^2$ into the other end. At the proper distance a third post, $C^3$, pierced by a pointed screw, furnished the means neces-




sary to allow the piece to be operated upon to rotate. The power for turning the flywheel was supplied by an assistant or assistants through the means of the narrow boards *B*, with holes bored through one end, and which fitted loosely on the crank handle. The operator with his chisel or tool undoubtedly squatted on the ground while operating, and as for the tool rest—well, that had been removed.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

AT the last annual meeting of the Council of Tampa, Fla., it was announced that the new Gas Company would be ready to furnish lights about January 10th, 1896.

IN our last issue, in speaking of the prosperity of the Bristol Company, of Waterbury, Conn., manufacturers of recording pressure gauges, etc., the error was made of locating the Company's headquarters at Bridgeport instead of Waterbury.

THE Peoria (Ills.) Gas Light and Coke Company expects, in the early spring. to make extensive additions to its main system, and in anticipation thereof has already placed with the Addyston Pipe and Steel Company, of Cincinnati, O., an order for something like 800 tons of pipe.

AN ordinance granting a franchise to an opposition Gas Company was introduced at the Atlantic City, N. J., Council meeting on Decem-23d. The new concern is to be known as the Atlantic Gas Company, and John Peter Perch, of Philadelphia, Pa., is said to be behind the scheme.

THE Berlin Iron Bridge Company, of East Berlin, Conn., has just completed for the H. W. Johns Mfg. Company, at Brooklyn, N. Y., a dryer house which is built entirely of steel.

AN ordinance has been adopted by the Town Trustees of Santa Monica, Cal., granting to Banks and Harms, of Los Angeles, Cal., a franchise for the construction of a gas works and the laying and maintaining of mains and connections within the town. The franchise is to run for 50 years; two years are allowed in which to begin operations.

MR. PATRICK CLARK, the efficient Superintendent of the Oneida (N. Y.) Gas Light Company, was, at the last meeting of the Directors, unanimously re-elected to his responsible position.

A CORRESPONDENT sends us the following: The East Saginaw (Mich.) Gas Company, under its present name and that of the East Saginaw Gas Light Company, has furnished the inhabitants of the East Side their illumination since away back in the sixties, rendering a service as complete and satisfactory as any in the State. In the early days consumers were scarce and the price of gas was something like $4 per 1,000; in 1884 gas for lighting sold for $2.25 and for fuel for $1.60. To-day the net cost per 1,000 cubic feet ranges from $1.40 to $1.10 for light and $1 for fuel. At the time of the introduction of the incandescent electric light everyone predicted the relegation of gas to the fuel field, as no gas would be used for lighting after a year or two; but the Gas Company did not lay down its arms so easily, for the Welsbach incandescent gas light came into the field, and, as evidence of its superiority, all of the best lighted stores in this city are now using this system of illumination and at a cost far below that of electric lighting. The fuel gas business has increased wonderfully every year, and so satisfactory are the results obtained that the principal residents use no other cooking appliance in their kitchens but the gas range. It goes almost without saying that coke and tar are by-products in the manufacture of coal gas, and can be obtained only from the Gas Company. The East Saginaw Gas Company was incorporated under the act of the Legislature with a capital stock of $300,000, all of which is held in the city. The officers are as follows: Wm. L. Webber, President; Henry C. Potter, Vice-President; George B. Morley, Secretary and Treasurer; Henry H. Hyde, Engineer and Superintendent.

IT is reported that there will shortly be a Pintsch gas plant erected in Louisville, Ky., to furnish gas to the cars of the various railways centering in that city.

LOWELL, Mich., on a vote of the people, held recently, decided to bond the town for $28,000 for an electric lighting plant on municipal account.

THE following "Notice to Gas Consumers" has been issued by the Gas Company at Syracuse (N. Y.): "From the first of the year 1896, the meters will be read and the gas bills will be rendered monthly instead of quarterly. It is believed that this change will be found more satisfactory to consumers, as it will give them a better opportunity of keeping account of their gas consumption and will enable them to settle their gas accounts monthly, as in the case of other accounts. The gas company takes this opportunity to say that it desires to give the consumers the best possible lighting effect for a given gas consumption and to that end it will be ready at all times to advise with the consumers. If the gas supply is in any way defective, complaint should be promptly made at the gas company's office and immediate correction will be made."

THE Jefferson City Gas Light Company, of New Orleans, La., has declared a semi-annual dividend of $2.50 per share, payable on and after Monday, Jan. 13th, 1896.

AN execution for $5,239.87 has been issued against the Elizabethtown Electric Light Company, of Elizabethtown, Pa., by the Westinghouse Electric and Manufacturing Company.

JAMES R. MCILVRIED, of Kansas City, Mo., has been granted a franchise in Topeka, Kas., which provides for the establishment of a complete modern gas plant and for the right of way in the streets for the laying and erection of all appurtenances necessary for the operation of the same. The company will be composed of Chicago, Kansas City and Topeka men, of whom Crawford James, of Kansas City, will be one of the largely interested. The promoters of the new plant are to furnish a $10,000 bond which must be signed by at least one local man, for the faithful performance of the work. The plant must be begun within six months after the passing of the ordinance and be completed in eighteen months. The company shall be held responsible for any suits that may be brought against the city in case of accident. A bond of $500 will also be required for the repairing of the streets. A feature about the franchise is the one which will result in netting the city a revenue when the plant is established. It provides that when the consumption of gas reaches 50,000,000 cubic feet the city shall receive one-half of 1 per cent. of the net receipts, and when 100,000,000, 1 per cent.; 150,000,000, 1½ per cent., and 200,000,000, 2 per cent. At the meeting whereat the opposition franchise was granted (Dec. 23, 1895), Judge J. T. Clark, Secretary of the Excelsior Coke and Gas Company, of Topeka, asked that the passing of the ordinance be deferred until the eastern people who had bought the plant could have time to reach the city. He said: "The people of Topeka have never objected to the price they paid for gas and have never requested that the company lower the price. If the city wants cheaper gas wait until the purchasers of the old plant get here, and arrange with them before letting in another company. Two companies cannot live. One will surely go under." Charles K. Holliday, Jr., as attorney for the old company, asked that the passing of the ordinance be deferred for a week, but without avail. The cost of the new plant, it is said, will approach $250,000.

THE Board of Aldermen, of New Haven, Conn., have voted an appropriation of $18,050 for gas light for 1896.

CHANCELLOR MCGILL, of New Jersey, has appointed Mr. J. D. Bennett, of Brooklyn, N. Y., receiver of the Rockaway (N. Y.) Electric Light Company, a corporation which lights Rockaway Beach. The liabilities are about $100,000 and the assets are $15,000. The receiver's bonds were fixed at $5,000.

THE Board of Gas and Electric Light Commissioners, of Massachusetts, have approved an issue of $20,000 bonds by the Citizens Gas Light Company, of Reading, South Reading and Stoneham. Of this amount $6,000 is to be applied to the payment of liabilities, now outstanding on account of the construction of the Company's new works in Stoneham, while $14,000 is to be applied to the extension of mains in Stoneham. The Company petitioned in January, 1895, for an issue of $50,000 bonds. On March 7, following, the Board approved $25,000 of the amount

asked for, and continued the case. The Company has therefore obtained $45,000 of the $50,000 petitioned for.

SAN LEANDRO, Cal., has voted to issue $10,000 bonds for a municipal electric light plant to furnish both arcs and incandescents.

THE New York Carbide and Acetylene Company has been incorporated. The capital is $7,000,000, and its purpose is to manufacture and sell gas producing materials and acetylene gas, and to distribute other than by the use of mains liquefied gas and to manufacture and deal in gas apparatus in Millbrook, Dutchess county, N. Y. The Directors are Elias C. Benedict, J. Bertschman, Anthony N. Brady, Edward N. Dickerson, Charles F. Dieterich, Walton Ferguson, John Fox, R. Somers Hayes, Erazm J. Jerzmanowski, Frederic P. Olcott, Arthur B. Proal, John Sloane. Samuel Thorne and Julius Suckert, of New York, take 69,988 of the 70,000 shares.

THE following interesting item, which appeared in the Columbus (O.) *Dispatch*, December 27th, 1895, has been forwarded to us by Mr. Irvin Butterworth, who says that Dr. Loving is one of the best known and most respected physicians of Columbus:

To the Editor of the *Dispatch:* I desire to say a word with reference to the improved gas lamps recently placed on East Broad street. As arranged, they afford the best street illumination I have ever seen. They throw light over the entire width of the street, and render it easy for one to walk or drive on the darkest night without fear of accident or assault. In this especially they are better than the electric lamps, which, while they illuminate the center of the streets (imperfectly), leave the sidewalks, even of the narrower streets, in almost complete darkness. In consequence, large numbers of people walk in the middle of the streets, at constant risk of injury and greatly to the inconvenience and annoyance of such as use horses and vehicles. The comfort and beauty of our streets would be greatly increased could they be furnished with gas lamps such as those on Broad street. Planted at even much greater distance apart I think they would still be superior to the electric lights, which make "a splendid display" when one is approaching the city by train, but fail in a large measure to fulfill the purpose for which they are intended. They do not light the streets. Yours truly, STARLING LOVING.

THE severe storm which struck Altoona (Pa.) on the evening of December 26th caused considerable loss to the Altoona Gas Company, partially demolishing its purifying house.

THE Creole Kitchen, for which William M. Crane & Co., gas appliance manufacturers, received a gold medal and diploma from the Atlanta Exposition, contained the following list of gas apparatus, comprising a complete gas kitchen outfit: Pastry oven, with plate warmer attached, utilizing the waste heat when baking; one large warming oven for keeping the dishes hot; three steam cookers for vegetables, etc.; one "Manhattan" oyster cooker with aluminum bowl; one special gas stove for baking waffles; one "Perfection" broiler and range; one laundry stove; several hot plates; one water back; one "Perfect" gas range.

THE Board of Gas and Electric Light Commissioners has issued a decision on the petition of the United Electric Light Company, of Springfield, Mass., which will be read with interest. The Company petitioned for approval of a bond issue of $200,000, and the Board refuses to grant the request. The decision deals with certain questions of corporate rights which have never come up before it previous to the discussion of this petition. "This was an application by the United Electric Light Company, of Springfield, for the approval of an issue of bonds to the amount of $200,000, $110,000 to be applied toward the funding of part of the Company's floating debt, and $90,000 for the construction and equipment of an auxiliary station. The debt which the Company seeks to fund by the issue of the bonds in question was incurred through the purchase of upward of 1,200 shares of the capital stock of the Indian Orchard Company at a cost of about $141,000. But for this the Company would be very nearly free from debt. The Indian Orchard Company is a Massachusetts corporation, the owner of an extensive tract of land, in part unimproved, in the village of Indian Orchard, in the city of Springfield, upon which are located several factory buildings and several tenement houses. This land is upon both sides of the Chicopee river, and includes a dam and canal and all the other accessories of a considerable water power. Its entire capital is divided into 2,150 shares of the par value of $100 each. It is chartered for the purpose of engaging in the business of 'manufacturing and selling all kinds of cotton, woolen, silk, iron and wood materials and products and manufacturing and selling electric lights and electricity for power and lighting purposes and leasing and selling mechanical power for manufacturing purposes.' For a time it operated a warp mill and now leases to others a part of its buildings and power. The United Electric Light Company, the petitioner, is authorized by its charter to furnish 'light and power by electricity and heat.' These charter powers suggest a question of great importance to the stockholders and the public as to the right of the petitioner to retain its ownership in the stock described. It is to be noted that this is not an investment of the surplus funds of the corporation to secure some income therefrom until they may be needed for other uses; neither have these stocks come into its possession through an attempt to enforce a claim or collect a debt. The Company's action in asking for long-term bonds indicates that it does not regard this ownership as a temporary holding, but as a permanent investment. This is not a mere purchase of land and water power for the Company's use. It is much more than that. The petitioner has, in fact, borrowed upon its own notes and invested an amount nearly equal to one-third of its capital stock in the control of another corporation organized for and actually engaged in a business wholly beyond the purpose of its own incorporation, and never in any degree contemplated by its articles of association. The original investment and the profits of the petitioner are thus exposed to new and unconsidered hazards to the prejudice of its shareholders and the public, by whom, singly or together, all the losses must be borne. It was developed at the hearing that the possession of the authority and of water power which might be used to generate electricity by the Indian Orchard Company made it for the interest of the petitioner to secure its control, so as thereby to dictate terms to any other quasi public electric corporation which might wish to use a part of this power and prevent the Indian Orchard Company from engaging, directly or indirectly, in the electric lighting business in competition with the United Electric Light Company. It has thus confessedly by its own act, without permission or approval of the State and indirectly sought the monopoly of an important public service. These facts seem to bring the purchase and retention of this stock by the petitioner within that class of investments which the courts, in consideration of the public interest, through a long line of decisions, have declared unlawful and contrary to a sound business policy. Doubtless the same consideration has induced the Legislature of this State to declare that no corporation 'shall direct its operations or appropriate its funds to any other purpose than that specified in its agreement of association or its charter.'" That part of the petition relating to $90,000 for a new power station is dismissed without prejudice to a new application for the same purpose.

THE Eastport (Me.) Gas and Electric Company has been superseded by the Eastport Lighting Company, formed under the laws of the State of Maine, with Wm. A. Carey, President and Manager; W. A. Whitney, Vice-President; Walter Campbell, Clerk. Resident Directors are H. H. Wadsworth and Walter Campbell.

AT the annual meeting of the Franklin Gas and Electric Light Company, of Franklin Falls, N. H., held December 21st, 1895, the following officers were elected: President, A. W. Sulloway; Clerk, F. N. Parsons; Treasurer, John P. Proctor. Directors, A. W. Sulloway, W. F. Daniell, F. L. Morrison, M. Duffy and James Aiken.

THE employees of the Brockton (Mass.) Gas Light Company sprang a surprise on Supt. E. B. Mooney, on the evening of December 23d, 1895, by presenting him with a handsome roll-top desk and chair in honor of his birthday and as an expression of their hearty goodwill. After the usual speeches everybody appreciated the good things Mrs. Mooney so hurriedly provided, and then the fun began. The "Gas House Nightingale," Mr. C. A. Bush, gave fine displays of his warbling abilities, and the Gas House Quartette, under the leadership of Conductor Bush, added to the pleasures of the evening. The absence of the veteran gas maker and respected workman, Mr. Dave Moran, was much lamented.

THE new gasometer of the Putnam (Conn.) Light and Power Company is giving entire satisfaction.

THE Directors of the Amherst (Mass.) Gas Company at their meeting of December 23d, 1895, completed the purchase of a piece of land near the line of the New London Northern Railroad, on which to erect a new building for their electric light station. The site is considered a most desirable one.

THE special committee on municipal lighting, of the Common Council, has reported, on the petition of the East Boston Citizens' Trade As-

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A. M. CALLENDER & CO.,
PROPRIETORS.

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sociation for a municipal gas plant in East Boston, that no further action is necessary on the part of the Common Council this year, it having already voted that it is expedient to establish municipal ownership of gas and electric lighting plants. The question is now before the aldermen for concurrent action.

REPRESENTATIVE LIVINGSTON, of Georgia, has introduced in the House a bill to incorporate the National Gas, Light, Heat and Power Company, of Washington, D. C., with a capital stock of $2,000.000. The incorporators named in the bill are C. D. Hauk, F. P. B. Sands, Park Agnew, Anthony Pollock, Renselaer Stone, C. C. Bryan and J. L. Hastings. The Company is authorized by the bill to produce 22-candle power gas free from impurities, and sell it for private use at the rate of 75 cents per 1,000 feet, and 60 cents per 1,000 feet for city street illumination and for use in the departments.

THE Philadelphia, Pa., *Press*, of December 31, 1895, has the following in regard to the U. G. I. Company:

At a special meeting of the stockholders of the United Gas Improvement Company, held yesterday, it was unanimously agreed to increase the capital stock of the Company from $10,000,000 to $11,500,000. There was not a dissenting vote, and over 80 per cent. of the capital stock was represented. After the call for the meeting had been read President Dolan submitted the result of the past year's business. To-day a meeting of the Board of Directors of the Company will be held to declare a dividend of 15 per cent. payable in cash on March 2, without interest, to stockholders of record, at the close of business, January 10. President Dolan in his report stated that the operation of the Company for 1895 was very successful, through the development of the Welsbach Light Company. He then stated the various conversion of stock through the Welsbach Commercial Company, which netted the United Gas Improvement Company a profit of $2,270,388. The report further stated: "Should you to-day vote to increase the capital stock of the Company by the amount of $1,500,000, it is proposed by the President and Board of Directors to pursue the following course, which will give to the stockholders the benefit of a special dividend from the specially large profit realized as above, and not wholly needed for the strengthening and extension of your properties, and at the same time preserve intact the Company's holding in the stock of the Welsbach Commercial Company, by which it controls the incandescent burner business of the United States, viz.: At the time of the declaration of the regular quarterly dividend of 2 per cent., payable January 15, 1896, to declare an extra dividend of 15 per cent., payable in cash on the 2d day of March. 1896, without interest, to stockholders of record at the close of business, January 10, 1896, or to their order."

## Tests of Concrete and Wire Flooring.

Concrete and wire flooring is being laid in several new business blocks now in course of erection in Providence, R. I. The object is to allow of greater span between the floor beams than is practicable with brick jack arches. Across the floor beams are stretched small wire cables, each composed of two galvanized wires twisted together. Round bars are then laid across the cables parallel with the beams and half way between them. Forms or centres are placed under the cables, and a composition consisting principally of plaster of paris and wood chips is poured on, the cables thus being imbedded in the concrete mixture, which solidifies in a few minutes. The vertical part of the concrete inclosing the floor beams is supported by wire netting passed around the flanges of the beam. If a flat ceiling is required iron bars are laid across the bottom flanges of the beams, over which wire netting is placed, and a thin layer of the composition is poured over this, leaving an air space between the floor and the ceiling.

The strength of this material was recently tested. Fifteen-inch I-beams, seven feet apart, had their flanges protected by a composition coating 1 inch thick. The composition filling between the beams was 5½ inches in thickness. The cables, made of two strands of No. 12 wire, were continuous over six spans, and were secured at the ends to loops of heavy wire hooked over the top flanges of the beams. The cables were spaced 1½ inches apart, and their deflection in each was regulated by an iron bar half an inch square. The weight of the floor was 24 pounds to the square foot, and it was designed to carry a live load of 170 pounds to the square foot. The length of the piece of floor tested was 12 feet parallel with the floor beams, and parts were cut out, leaving four sections 7x5 feet in adjacent spans to sustain the weight.

The weight of 155 pounds, falling 6 feet, went through the floor at the eleventh blow. The same weight, falling 10 feet, went through at the fourth blow. No. 2 section was tested by loading the half span up to 100 pounds to the square foot, giving an eccentric loading, but when the weight was removed the floor returned to about its original position. Section No. 3 was tested by a uniform loading up to 700 pounds per square foot; the floor deflected $\frac{3}{16}$ inch at the centre, but returned $\frac{1}{16}$ inch when the load was removed. Then the section was reloaded to 1,500 pounds per square foot—nearly 27 tons, on an area of 7x5 feet—and some of the filling was destroyed, but none of the pig iron weights were forced through the floor and none of the wires broke. A hot fire was kept under section 4 for an hour. The temperature of the beams was increased 2 degrees and water from the fire hose was turned on the top and bottom of the filling, none breaking loose. Next morning this section was uninjured by a load of 1,000 pounds per square foot.—*The Metal Worker.*

## The Market for Gas Securities.

There was nothing of particular moment reported during the week in transactions in gas stocks on the Exchange, albeit the quotations for Consolidated were somewhat lower than those for the previous week. The price came in to-day (Friday) with sales at 148. The lawmaking powers at Albany having gathered together for the annual harvesting, investors are now waiting for the announcement by Speaker Fish of the names of the gentlemen who are to compose the Assembly Committee on Gas, Water and Electricity—notably the chairman thereof. Whoever they are that are to serve, however, in our opinion, will not count greatly, since the temper of the Governor fairly leads to the belief that nothing tending to unduly harass incorporated companies will receive Mr. Morton's sanction. The following resumé of the course of Consolidated during the year will likely prove of interest: The total sales on the Exchange amounted to 180,030 shares (about one-half of the company's capital), the opening having been made at 130. The highest figure reached was 161½; the lowest was 126; the concluding sale was registered at 148½. This record shows a net gain in 1895 for the stock of 17½ points—not a bad showing. We understand that the business of the company shows a substantial advance over that done in 1894.

All other city gas shares are at lower figures, notably Equitable, which is offered at 205, while the bid rate is 198. Mutual is quoted at 220 to 235. New York and East River is down to 30 to 32 for the common, and as to the preferred the difference between buyers and sellers is rated at 10 points, a fairly reliable quotation for it being 67 to 75. Standard shares are also dull and lower, the common being quoted at 67 to 69 and the preferred at 104 to 106. Another feature of the market is the strength displayed by the bond issues of the various companies, Equitable 5's and Standard 5's being in good demand.

Brooklyn Union stock is dull and sluggish, around 75 bid, holders asking two points over that quotation. Those who watch the situation in Brooklyn closely incline to the view that even at the figures quoted the shares are yet a trifle high. The coming spring is bound to show many economies in the business of gas supply in Brooklyn, and Treasurer Chapman is certainly displaying very clever qualities as an astute financier. Several forecasts have recently been made respecting the eventual permanent officers of the Company, but it does not seem to us that any of them can be said to be near the mark. One thing, however, can be said, which is that the quantity of gas sold in Brooklyn last month was considerably greater than that disposed of in any other December in the history of the business in that city. Chicago gas was fairly steady, with an inclination towards better prices. The progress in the matter of the reorganization of the Company is quite satisfactory. The opening price to-day was 65½ to 65¾. Baltimore Consolidated is uneven at 57½ bid, ex-dividend, and Western gas is offered at 65, ex-dividend. This stock looks to us like a purchase. The downward tendency in Consumers, of Jersey City, is still in evidence, and we have been unable to determine any good reason therefor. It is understood, however, that quite a round block of the stock has been marketed by a holder who had been quite an advocate of it for investment. Bay State gas is neglected at 20 to 23, and the Laclede shares are also in the same category. We note a sale at auction of 10 shares Laclede preferred at 78. Cincinnati gas within the week sold down to 199¾. Oakland (Cal.) gas is at its highest figure, 50¼, and San Francisco gas is in steady demand at rising prices, notwithstanding there has been no settlement made between the Gas Company and the Edison Light and Power Company. The last sales are reported at 72¼.

## Gas Stocks.

**Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.**

35 WALL ST., NEW YORK CITY.

JANUARY 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $35,430,000 | 100 | 148 | 148¼ |
| Central | 500,000 | 50 | 150 | .. |
| " Scrip | 220,000 | .. | 100 | . |
| Equitable | 4,000,000 | 100 | 205 | 215 |
| Bonds, 6's | 1,000,000 | 1,000 | 105 | .. |
| " 1st Con. 5's | 2,300,000 | 1,000 | 114 | . |
| Metropolitan Bonds | 658,000 | .. | 108 | 112 |

| | | | | |
|---|---|---|---|---|
| Mutual | 3,500,000 | 100 | 220 | .. |
| " Bonds | 1,500,000 | 1,000 | 100 | 102 |
| Municipal Bonds | 750,000 | .. | .. | . |
| Northern | 150,000 | 50 | 79 | 80½ |
| " Bonds | 150,000 | 1,000 | .. | 98 |
| New York and East River | 5,000,000 | 100 | 30 | 32 |
| Preferred | 2,000,000 | 100 | 65 | 70 |
| Bonds 1st 5's | 3,500,000 | 1,000 | 100 | 101½ |
| " 1st Con. 5's | 1,500,000 | .. | 90 | 90¼ |
| Richmond Co., S. I. | 348,650 | 50 | 50 | .. |
| " Bonds | 100,000 | 1,000 | .. | .. |
| Standard | 5,000,000 | 100 | 68 | 70 |
| Preferred | 5,000,000 | 100 | 103 | 107 |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 105 | .. |
| Yonkers | 200,650 | 50 | 112 | .. |
| *Gas Co's of Brooklyn.* | | | | |
| Brooklyn | 2,000,000 | 25 | 140 | .. |
| Citizens | 1,200,000 | 20 | 70 | .. |
| " S. F. Bonds | 320,000 | 1,000 | .. | 101 |
| Equity | 2,000,000 | 10 | .. | .. |
| " Bonds | 1,000,000 | .. | .. | .. |
| Fulton-Municipal | 3,000,000 | 100 | 220 | .. |
| " Bonds | 300,000 | .. | 103 | .. |
| Peoples | 1,000,000 | 10 | 100 | . |
| " Bonds, 7's | 368,000 | .. | 100 | .. |
| " " 6's | 94,000 | .. | 98 | 100 |
| Metropolitan | 870,000 | 100 | 200 | .. |
| " Bonds, 5's | 70,000 | .. | .. | .. |
| Nassau | 1,000,000 | 25 | 310 | .. |
| " Ctfs | 700,000 | 1,000 | 99 | 100 |
| Williamsburgh | 1,000,000 | 50 | 310 | .. |
| " Bonds | 1,000,000 | .. | 107 | 110 |
| *Out-of-Town Companies.* | | | | |
| Bay State | 5,000,000 | 50 | 23 | 25 |
| " Income Bonds | 2,000,000 | 1,000 | .. | 30 |
| Boston United Gas Co.— | | | | |
| 1st Series S. F. Trust | 7,000,000 | 1,000 | 78 | 80 |
| 2d " " " | 3,000,000 | 1,000 | 54 | 55 |
| Buffalo Mutual | 750,000 | 100 | 125 | .. |
| " Bonds | 200,000 | 1,000 | 95 | 100 |
| Central, San Francisco | 2,000,000 | .. | 95 | .. |
| Chicago Gas Co. | 25,000,000 | 100 | 65½ | 65¾ |
| Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds. | 7,650,000 | 1,000 | 94 | 94¼ |
| Columbus | 1,069,000 | .. | 66½ | 67 |
| 1st Mortgage | 1,085,000 | .. | 94 | 95 |
| Consumers, Jersey City | 2,000,000 | 100 | .. | 85 |
| " Bonds | 600,000 | 1,000 | 100 | 102 |
| Cincinnati G. & C. Co. | 7,000,000 | 100 | 208¾ | .. |
| Consumers, Toronto | 1,600,000 | 50 | 184½ | 187 |
| Capital, Sacramento | 500,000 | 50 | .. | 41 |
| Bonds (6's) | 150,000 | .. | .. | .. |
| Consolidated, Baltimore | 11,000,000 | 100 | 57 | 59 |
| Mortgage, 6's | 3,600,000 | .. | 107 | 107½ |
| Chesapeake, 1st 6's | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490,000 | .. | .. | .. |
| Detroit | 4,000,000 | .. | .. | 30 |
| " Con. Bonds | 4,312,000 | .. | 71½ | 75 |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Fort Wayne | 2,000,000 | .. | 73 | 76 |
| " Bonds | 2,000,000 | .. | 86 | 88 |
| Hartford | 750,000 | 25 | 130 | 135 |
| Indianapolis | 2,000,000 | .. | .. | 145 |
| " Bonds, 6's | 2,650,000 | .. | 100 | 104 |
| Jersey City | 750,000 | 20 | 180 | .. |
| Lafayette Gas Co., Ind | 1,000,000 | 100 | 82 | 83 |
| Bonds | 1,000,000 | 1,000 | 85 | 88 |
| Louisville | 2,570,000 | 50 | .. | 130 |
| Laclede, St. Louis | 7,500,000 | 100 | 20½ | 21½ |
| Preferred | 2,500,000 | 100 | 80 | .. |
| Bonds | 9,084,400 | 1,000 | 93½ | 93⅝ |
| Little Falls, N. Y. | 50,000 | 100 | .. | 100 |
| Bonds | 25,000 | .. | .. | 100 |
| Montreal, Canada | 2,000,000 | 100 | 200 | . |
| Newark, N. J., Gas Co. | 1,000,000 | .. | 75 | . |
| Bonds, 6's | 4,000,000 | .. | 120 | .. |
| New Haven | 1,000,000 | 25 | 225 | .. |
| Oakland, Cal. | 2,000,000 | .. | 46½ | .. |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 2,100,000 | 1,000 | .. | 108 |
| 2d " | 2,500,000 | 1,000 | 104 | 105 |
| Peoples, Jersey City | 500,000 | 50 | .. | 175 |
| Paterson, N. J. | ..... | 25 | 99 | 102 |
| Rochester Gas & Elec. Co. | 2,150,000 | 50 | .. | .. |
| Preferred | 2,150,000 | 50 | 88 | .. |
| Consolidated 5's | 2,000,000 | .. | 87½ | 90 |
| San Francisco, Cal. | 10,000,000 | 100 | 71½ | 72 |
| St. Paul Gas Light Co. | 1,500,000 | 100 | 68½ | 70 |
| 1st Mortgage, 6's | 650,000 | .. | 88 | 90 |
| Extension, 6's | 600,000 | .. | .. | .. |
| General Mortgage, 5's | 2,400,000 | .. | 88 | 90 |
| Syracuse, N. Y. | 500,000 | 25 | .. | .. |
| Washington, D. C. | 2,000,000 | 20 | 250 | .. |
| Western, Milwaukee | 4,000,000 | 100 | .. | 70 |
| Bonds, 5's | 3,556,000 | .. | .. | 90 |
| Wilmington, Del. | 500,000 | 50 | 188 | 190 |

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## DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., 813 DREXEL BUILDING, PHILA., Dec. 31, 1895.

The Directors have this day declared a quarterly dividend of 2 per cent. ($1 per share), payable in cash on Jan. 15, 1896, to stockholders of record at the close of business Jan. 10, 1896; also an extra dividend of fifteen (15) per cent. ($7.50 per share) payable in cash on the 3d day of March, 1896, without interest, to stockholders of record at the close of business Jan. 10, 1896. The right to participate in said extra dividend will be evidenced by the issue, on Jan. 15, 1896, of dividend scrip certificates to stockholders of record at the close of business Jan. 10, 1896. Said certificates will, at the option of the holder, if exercised on or before the 29th day of February, 1896, be convertible into the capital stock of the Company at par, when presented in sums of fifty dollars ($50) or multiples thereof. Checks and dividend scrip certificates will be mailed.

1074-2 EDWARD C. LEE, Treasurer.

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A thoroughly skilled and competent Gas Engineer is open to engagement. European and American experience. Familiar with every detail of the gas business.

1074-1 Address "L.," care this Journal

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**As Supt. or Asst. Supt. of Coal or Water Gas Works**

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**As Superintendent.**

Superintendent in charge of gas works making 17,000,000 cubic feet per annum desires change of locality. Has been with present company five years. Address

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**As Supt. or Manager of a Gas Works or Gas and Electric Light Works.**

Fifteen years' experience as Manager of Gas Works and six years Gas and Electric Light Works. Good reasons for wishing to change present employment.

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**A Position as Supt. of a Large or Small Gas Works.**

Is capable and energetic, and is willing to begin at a moderate salary. Address

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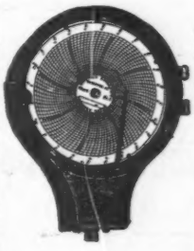

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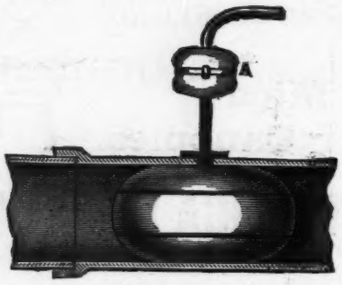


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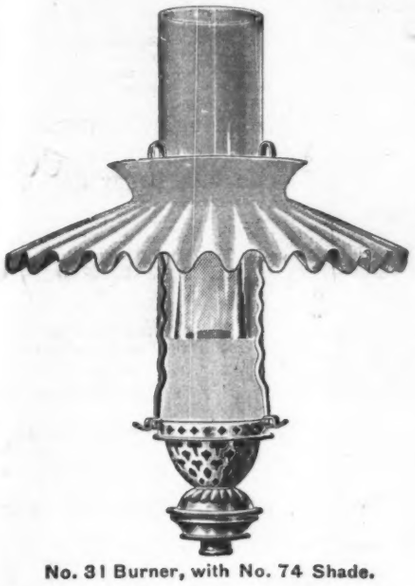

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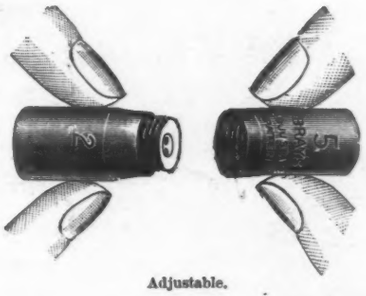

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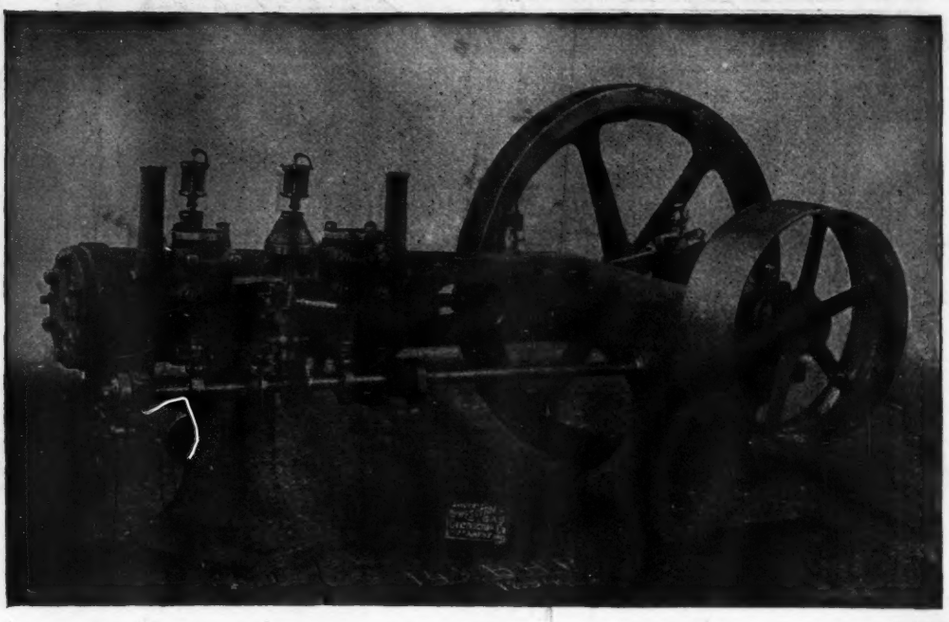

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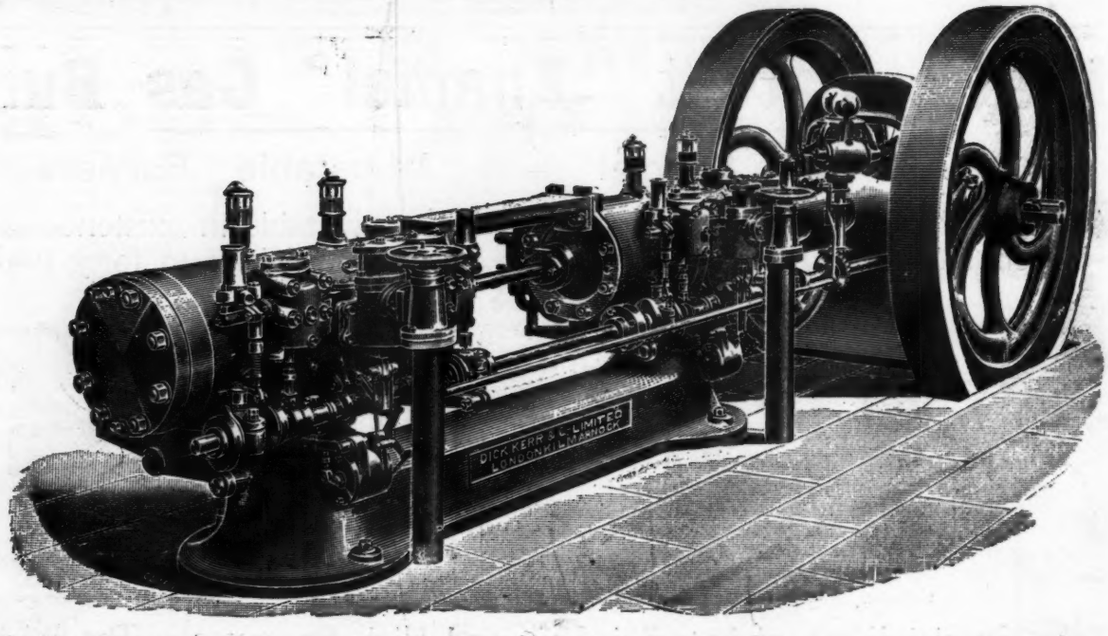


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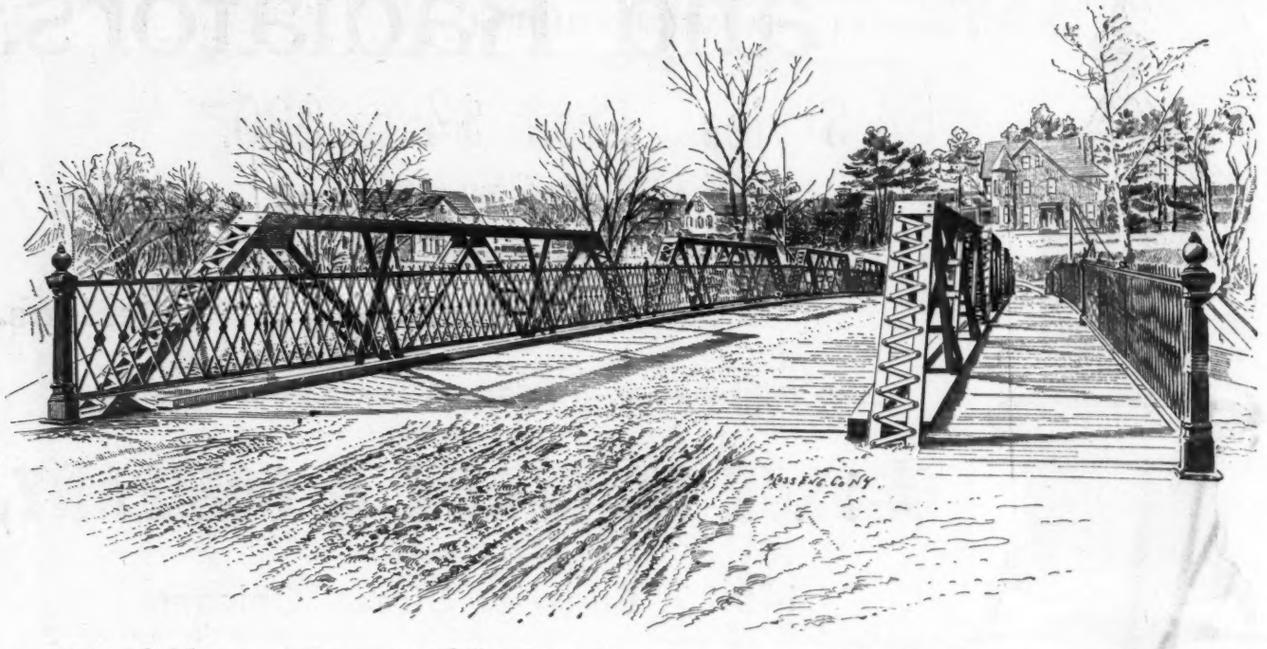

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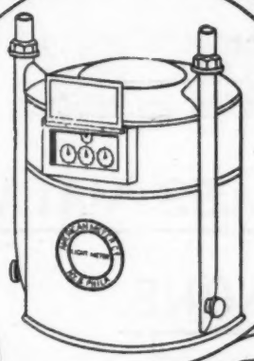

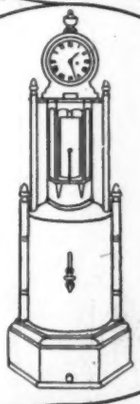

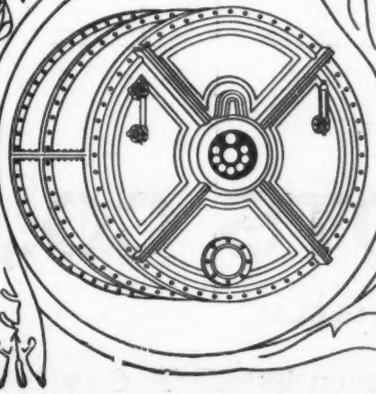

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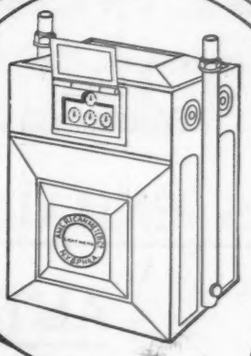
## PUBLIC LIGHTING TABLE.

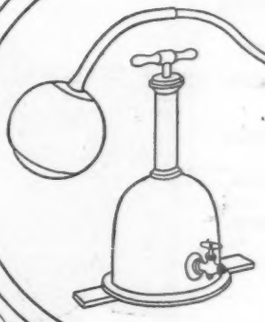
### JANUARY, 1896.

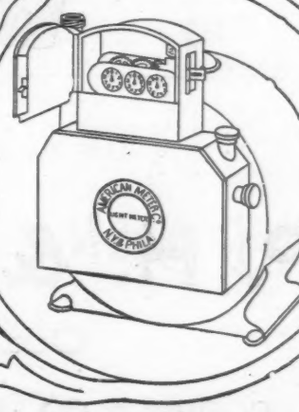
| Day of Week. | Date. | Table No. 1. Following the Moon. Light. | Table No. 1. Following the Moon. Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Table No. 2. New York City. All Night Lighting. Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Wed. | 1 | No L. | No L. | 4.30 | 6.30 |
| Thu. | 2 | 5.20 PM | 7.50 PM | 4.30 | 6.30 |
| Fri. | 3 | 5.20 | 9.10 | 4.30 | 6.30 |
| Sat. | 4 | 5.20 | 10.30 | 4.30 | 6.30 |
| Sun. | 5 | 5.20 | 11.40 | 4.30 | 6.30 |
| Mon. | 6 | 5.20 | 12.50 AM | 4.30 | 6.30 |
| Tue. | 7 | 5.20 LQ | 2.10 | 4.30 | 6.30 |
| Wed. | 8 | 5.20 | 3.20 | 4.40 | 6.30 |
| Thu. | 9 | 5.20 | 4.30 | 4.40 | 6.30 |
| Fri. | 10 | 5.20 | 5.40 | 4.40 | 6.30 |
| Sat. | 11 | 5.20 | 6.20 | 4.40 | 6.30 |
| Sun. | 12 | 5.30 | 6.20 | 4.40 | 6.30 |
| Mon. | 13 | 5.30 | 6.20 | 4.40 | 6.30 |
| Tue. | 14 | 5.30 NM | 6.20 | 4.40 | 6.30 |
| Wed. | 15 | 5.30 | 6.20 | 4.50 | 6.25 |
| Thu. | 16 | 5.30 | 6.20 | 4.50 | 6.25 |
| Fri. | 17 | 5.30 | 6.20 | 4.50 | 6.25 |
| Sat. | 18 | 5.30 | 6.20 | 4.50 | 6.25 |
| Sun. | 19 | 8.50 | 6.20 | 4.50 | 6.25 |
| Mon. | 20 | 9.50 | 6.20 | 4.50 | 6.25 |
| Tue. | 21 | 10.50 | 6.20 | 4.50 | 6.25 |
| Wed. | 22 | 11.50 FQ | 6.20 | 5.00 | 6.25 |
| Thu. | 23 | 1.00 AM | 6.20 | 5.00 | 6.25 |
| Fri. | 24 | 2.00 | 6.20 | 5.00 | 6.25 |
| Sat. | 25 | 3.10 | 6.20 | 5.00 | 6.25 |
| Sun. | 26 | 4.10 | 6.10 | 5.00 | 6.25 |
| Mon. | 27 | 5.10 | 6.10 | 5.00 | 6.25 |
| Tue. | 28 | No L. | No L. | 5.00 | 6.25 |
| Wed. | 29 | No L. FM | No L. | 5.05 | 6.15 |
| Thu. | 30 | No L. | No L. | 5.05 | 6.15 |
| Fri. | 31 | 5.50 PM | 8.10 PM | 5.05 | 6.15 |

### TOTAL HOURS LIGHTING DURING 1896.

| By Table No. 1. | Hrs.Min | By Table No. 2. | Hrs.Min. |
|---|---|---|---|
| January | 220.40 | January | 423.20 |
| February | 207.00 | February | 367 40 |
| March | 193.00 | March | 355.35 |
| April | 174.10 | April | 298.50 |
| May | 164.00 | May | 264.50 |
| June | 142.10 | June | 234.25 |
| July | 142 10 | July | 243.45 |
| August | 150.50 | August | 280.25 |
| September | 163.00 | September | 321.15 |
| October | 193.10 | October | 374.30 |
| November | 207.00 | November | 401.40 |
| December | 237.30 | December | 433.45 |
| Total, yr. | 2194.40 | Total, yr. | 4000.00 |







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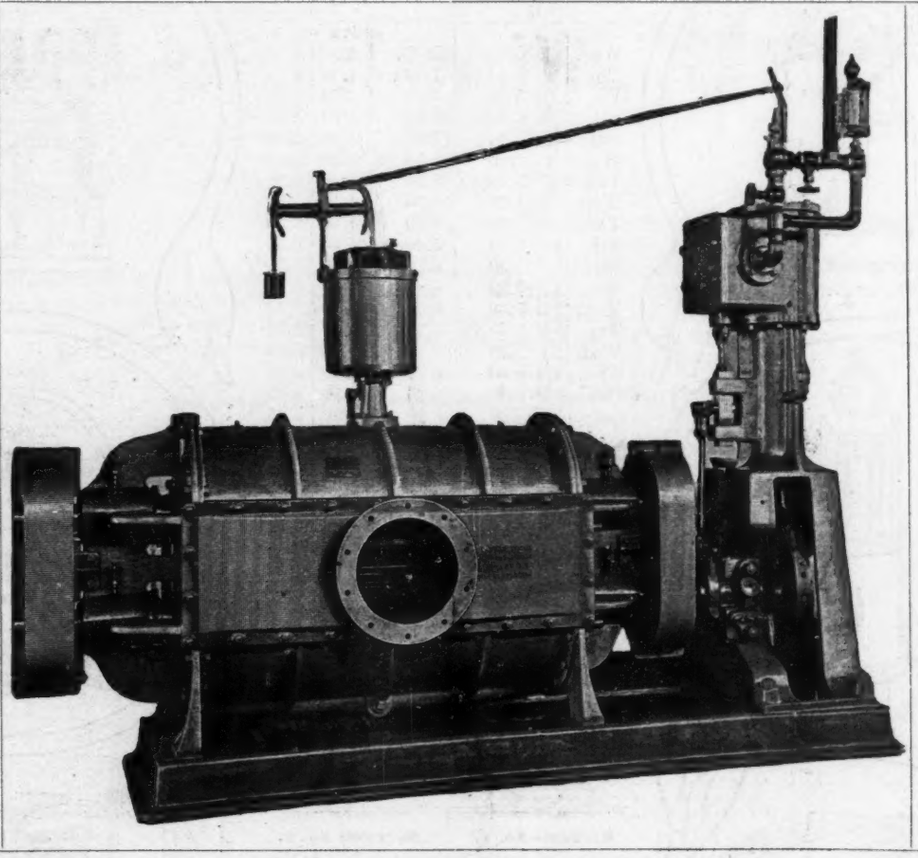

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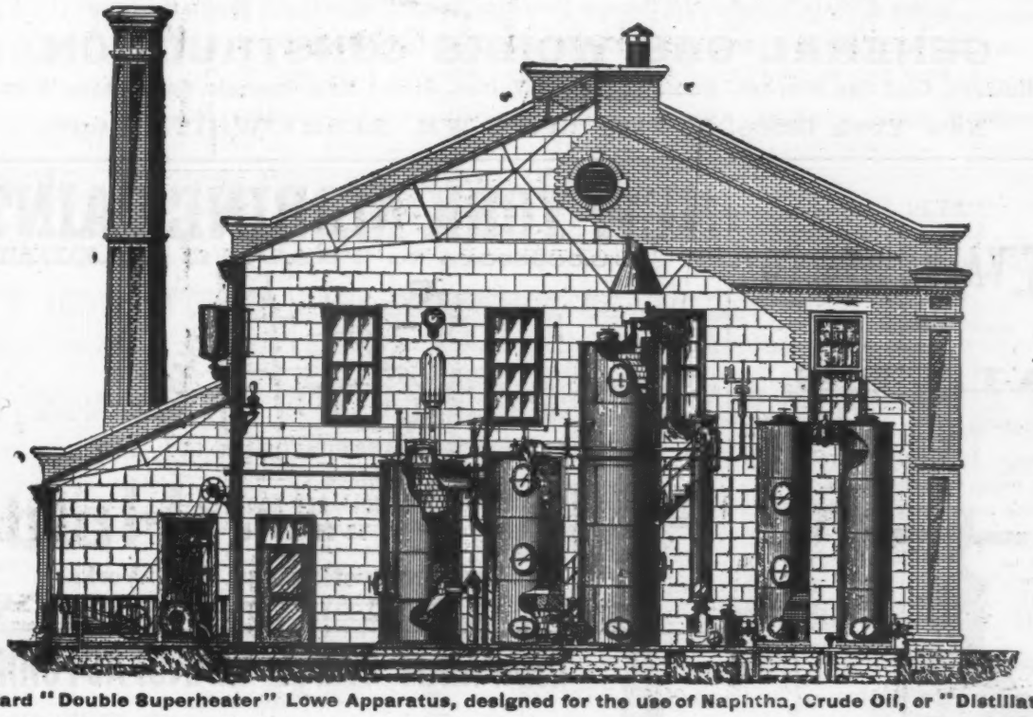

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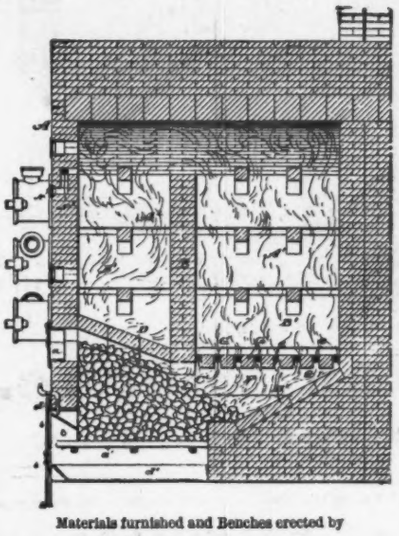

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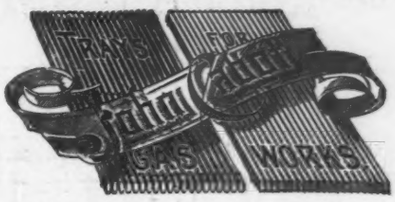


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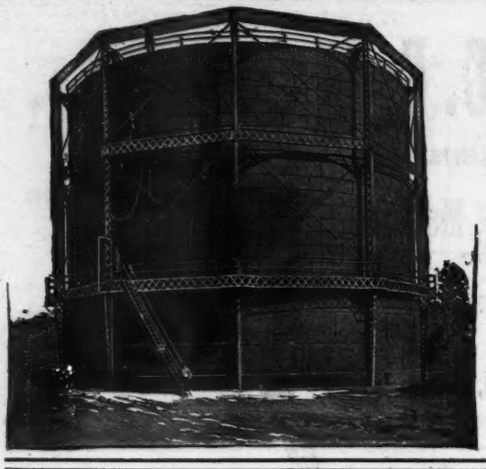

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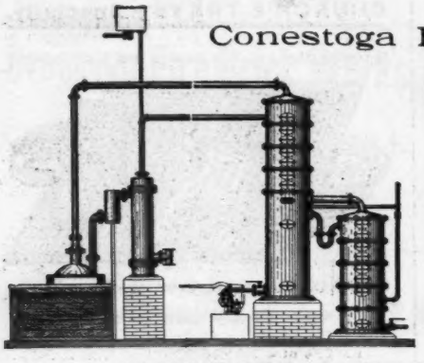

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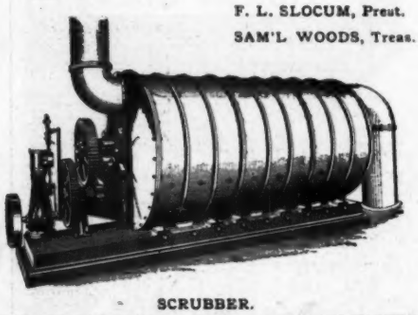

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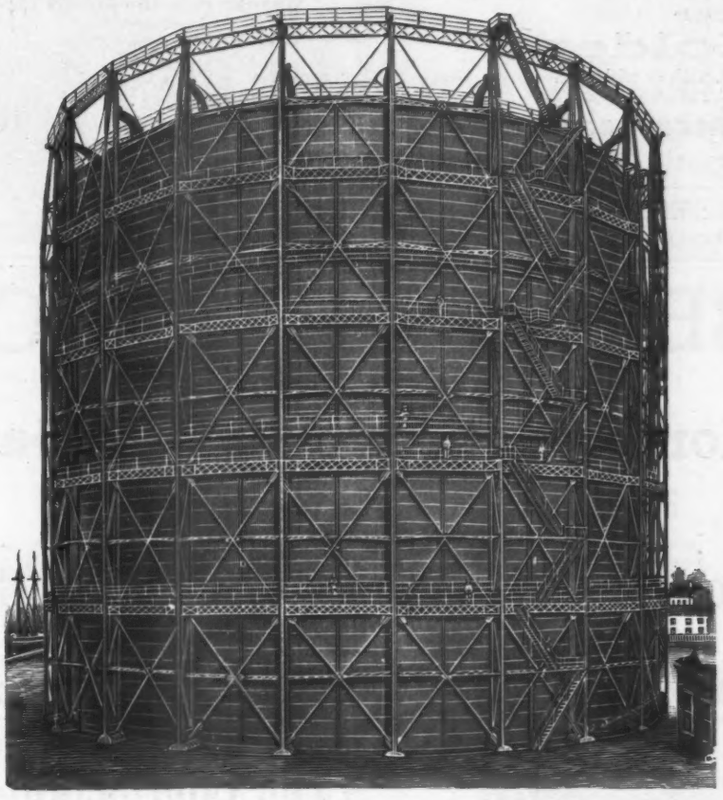

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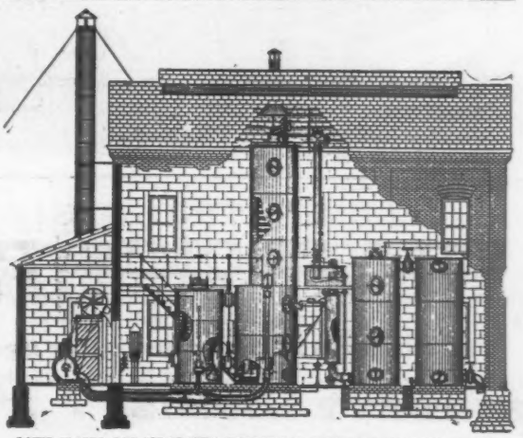

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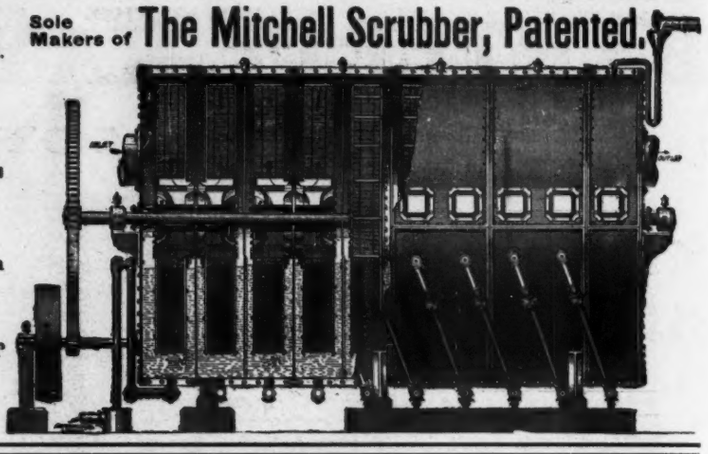

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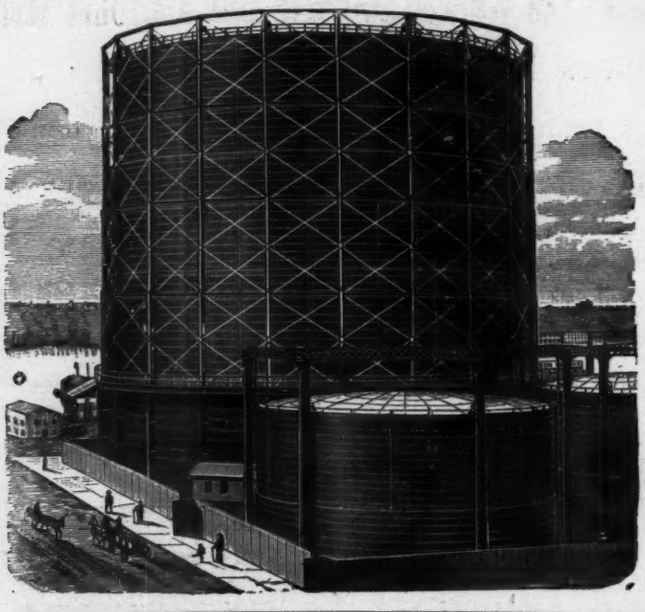

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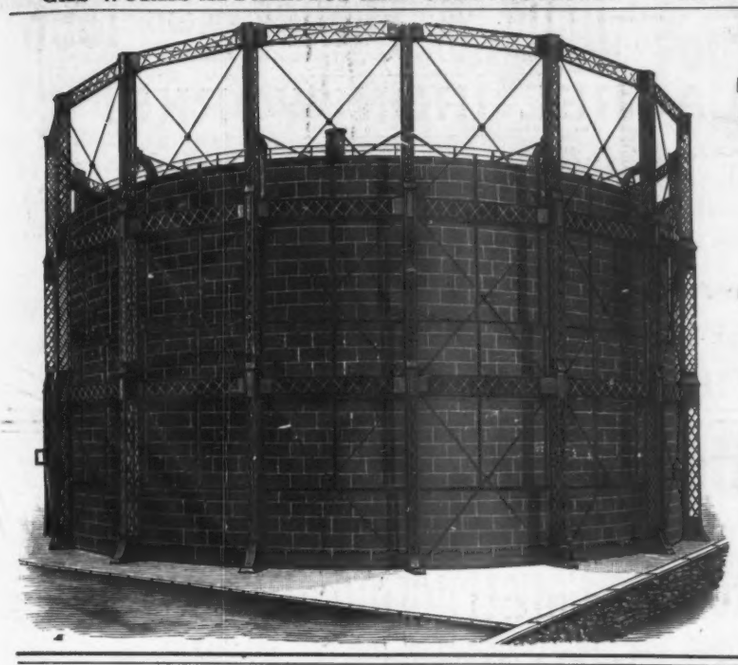

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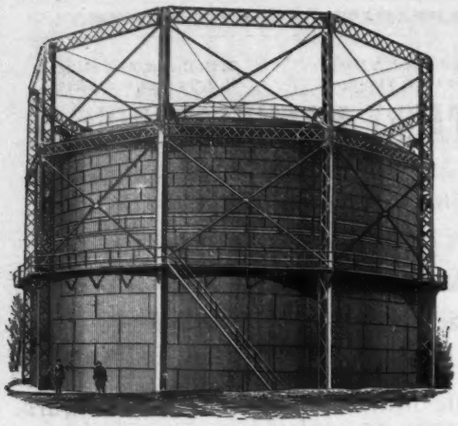

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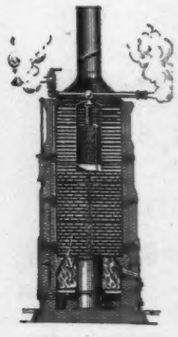

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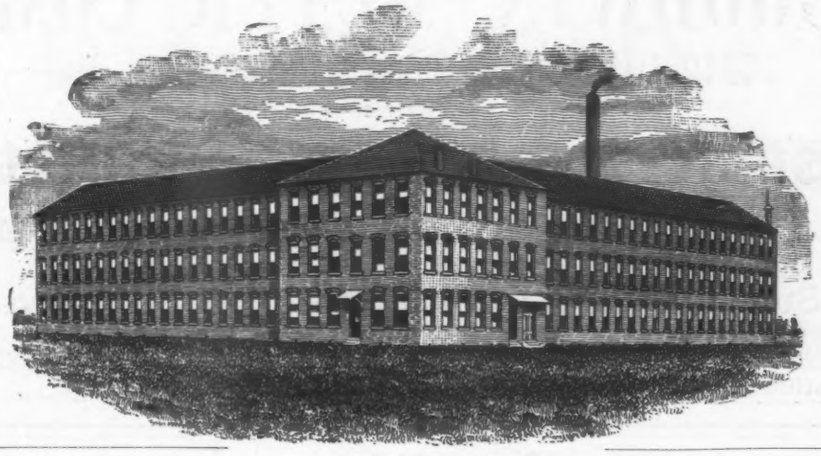

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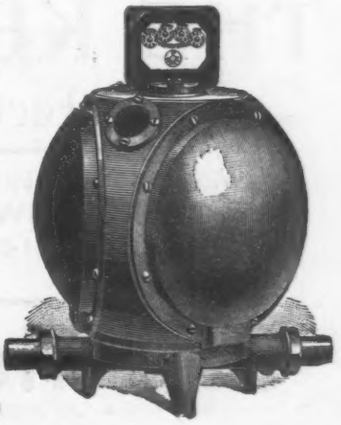

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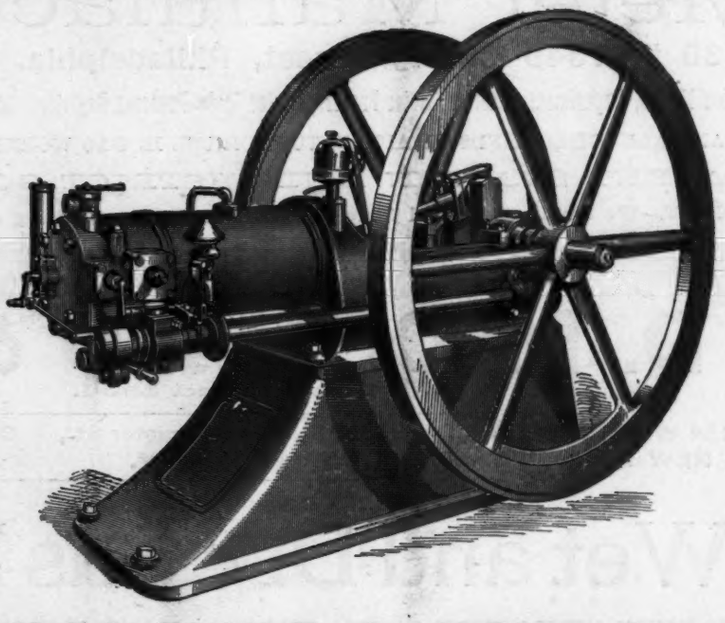

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